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EPA Utility FGD Survey
April-May 1978

PEDCo-Environmental, Inc, Cincinnati, OH

Prepared for

Industrial Environmental Research Lab, Research Triangle Park, NC

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Research Triangle Park NC 27711

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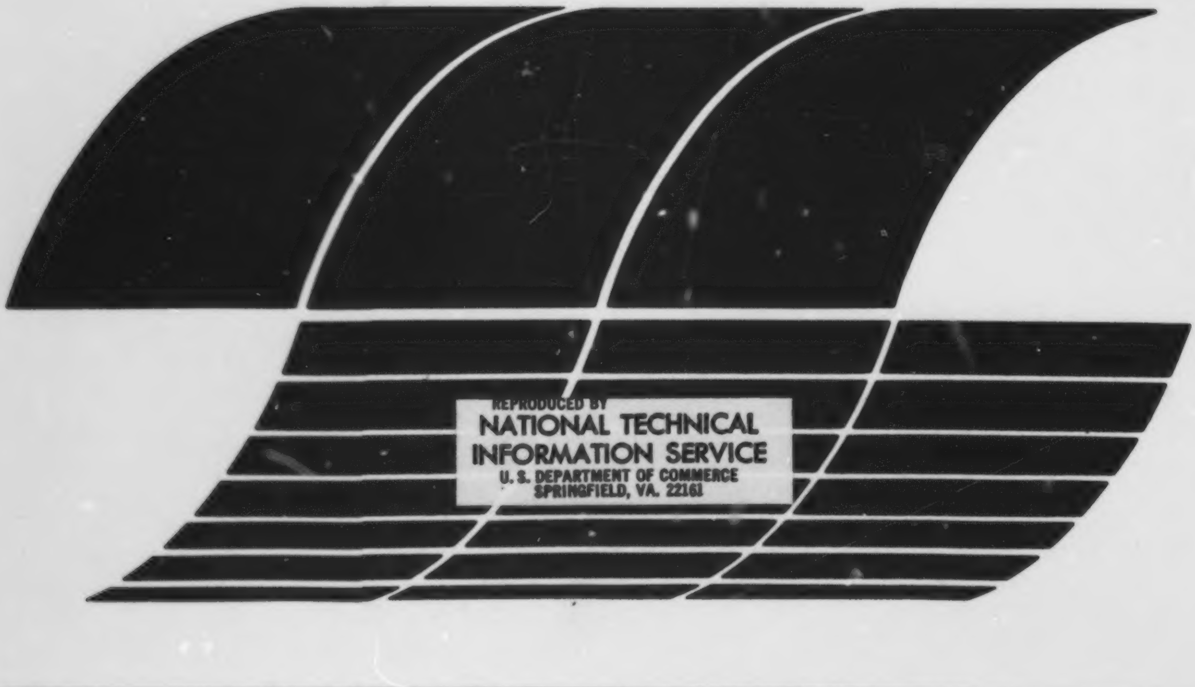
EPA Utility FGD Survey: April-May 1978

Interagency Energy/Environment R&D Program Report



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16. ABSTRACT

The report is an updated supplement to EPA-600/78-051a and should be used in conjunction with it. It presents a survey of utility flue gas desulfurization (FGD) systems in the U.S., summarizing information contributed by the utility industry, process suppliers, regulatory agencies, and consulting engineering firms. Systems are tabulated alphabetically, by development status (operational, under construction, in planning stages, or terminated operations), by utility company, by process supplier, by process, by waste disposal practice, and by regulatory class. It presents data on system design, fuel sulfur content, operating history, and actual performance. It discusses problems and solutions associated with the boilers and FGD systems. Process flow diagrams and FGD system economic data are appended to the report.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS		b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pollution	Maintenance	Pollution Control	13B
Flue Gases		Stationary Sources	21B
Desulfurization		Utility Boilers	07A, 07D
Electric Utilities			
Waste Disposal			15E
Boilers			13A

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EPA-600/7-78-051c

September 1978

EPA Utility FGD Survey:
April-May 1978

by

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U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Research and Development
Washington, DC 20460

NOTICE

This report, (prepared by PEDCo Environmental, Inc., Cincinnati, Ohio, under EPA Contract No. 68-01-4147, Task No. 52) is provided as an information transfer document. Data in this report are supplied voluntarily by utility representatives; flue gas desulfurization (FGD) system designers, vendors, and suppliers; regulatory personnel; and others. Neither EPA nor the designated contractor warrants the accuracy or completeness of information contained in this report.

This report is the second of five supplementary issues to the December 1977 - January 1978 report. Supplementary issues are cumulative, so that it is necessary only to retain the latest issue and the December 1977 - January 1978 report (EPA-600/7-78-051a).

Initial distribution of the report (generally, one copy per company) is limited to organizations and individuals indicating a specific interest in the field of FGD technology. Additional copies of this report and succeeding issues can be purchased from National Technical Information Service, Springfield, Virginia 22151.

CONTENTS

Page

Notice ii
Tables vi
Executive Summary and Highlights vii

Section 1 Summary List of FGD Systems 1

Section 2 Status of FGD Systems 4

Section 3 Performance Description of Operational FGD Systems 22
- Arizona Public Service
  - Cholla 1 22
  - Cholla 2 23
- Columbus and Southern Ohio Electric
  - Conesville 5 24
  - Conesville 6 25
- Duquesne Light
  - Elrama 1-4 26
  - Phillips 1-6 28
- Indianapolis Power and Light
  - Petersburg 3 29
- Kansas City Power and Light
  - Hawthorn 3 30
  - Hawthorn 4 31
  - La Cygne 1 32
- Kansas Power and Light
  - Lawrence 4 33
  - Lawrence 5 34
- Kentucky Utilities
  - Green River 1, 2, and 3 35
- Louisville Gas and Electric
  - Cane Run 4 37
  - Cane Run 5 38
  - Paddys Run 6 39
- Minnkota Power Cooperative
  - Milton R. Young 2 40
- Montana Power
  - Colstrip 1 41
  - Colstrip 2 42

CONTENTS (continued)

Page

Nevada Power
    Reid Gardner 1 43
    Reid Gardner 2 44
    Reid Gardner 3 45
Northern Indiana Public Service
    Dean H. Mitchell 11 46
Northern States Power
    Sherburne County Station 1 48
    Sherburne County Station 2 49
Pennsylvania Power
    Bruce Mansfield 1 50
    Bruce Mansfield 2 51
Philadelphia Electric
    Eddystone 1A 52
Public Service Company of New Mexico
    San Juan 1 53
South Carolina Public Service
    Winyah 2 54
Springfield City Utilities
    Southwest 1 55
Tennessee Valley Authority
    Shawnee 10A 56
    Shawnee 10B 57
    Widows Creek 8 59
Texas Utilities
    Martin Lake 1 61
    Monticello 3 62
Utah Power and Light
    Huntington 1 63

Section 4 Summary of FGD Systems by Company 64

Section 5 Summary of FGD Systems by Vendor 65

Section 6 Summary of New and Retrofit FGD Systems by Process 67

Section 7 Summary of Operating FGD Systems by Process and Generating Units 68

Section 8 Summary of Sludge Disposal Practices for Operational FGD Systems 70

Section 9 Summary of FGD Systems by Process and Regulatory Class 71

Section 10 Summary of FGD Systems Under Construction 73

CONTENTS (continued)

Page

Section 11 Summary of Planned FGD Systems 75

Section 13 Total of FGD Megawatt Capacity by Year 78

Appendix A FGD Systems Economics A-1
Appendix B FGD Process Flow Diagrams B-1
Appendix C Definitions C-1

TABLES

No.		Page
I	Number and Total MW of FGD Systems	vii
II	Summary of Changes: FGD Summary Report, April-May 1978	x
III	Performance of Operational Units During April-May Period	xii

EXECUTIVE SUMMARY

This report is prepared every other month by PEDCo Environmental, Inc., under a contract to the Industrial Environmental Research Laboratory/RTP and the Division of Stationary Source Enforcement of the U.S. Environmental Protection Agency. Table 1 summarizes the current status of the FGD systems addressed in this 2-month period.

Table I

NUMBER OF TOTAL MW OF FGD SYSTEMS

Status	No. of units	MW
Operational	37	12,862
Under construction	43	17,177
Planning:		
Contract awarded	19	10,606
Letter of intent	3	892
Requesting/evaluating bids	2	855
Considering only FGD systems	34	16,552
TOTAL	138	58,944

Table II (page x) summarizes the individual units that changed status during the reporting period.

The performance of the operating systems is summarized in Table III (page xii). Other activity highlights during the months of April and May are summarized below:

The present total power-generating capability of the electric utility industry in the United States is approximately 532.4 GW[a].

Of this total, approximately 250 GW^b, representing 47 percent of the total, is generated by coal. As indicated in Table I, 36 FGD-equipped coal-fired units, representing 12,112 MW of power capability, are now in service. Thus, a little over 2 percent of the total utility power-generating capacity and a little under 5 percent of the utility coal-fired capacity are controlled by FGD. By 1986, the projected total power-generating capacity of the electric utility industry in the United States will be approximately 812.7 GW^a. This represents an increase of 53 percent over the present total and includes retirements of older units (0.4 percent annual average based on year-end power-generation capability). Of the 1986 total, approximately 363.2 GW^{a,b,c}, representing 45 percent of the total, will be generated by coal. As indicated in Table I, 138 FGD-equipped coal-fired units, representing 58,944 MW of power capacity, are now scheduled for operation by 1986. Thus, approximately 7 percent of the projected total generating capacity and 16 percent of the projected coal-fired capacity will be controlled by FGD by the end of 1986.

HIGHLIGHTS: APRIL-MAY 1978

Arizona Public Service reported that Cholla 2 became operational during the period. Compliance testing should be completed by August 15 and commercial startup is expected in August 1978. Cholla 1 demonstrated a total system reliability of 25 percent in April.

A contract was awarded to Combustion Engineering for a lime FGD system at Eastern Kentucky Power's 500 MW Spurlock 2 located near Maysville, Kentucky. Spurlock 2 will utilize a 99.5 percent ESP for particulate removal.

Hoosier Energy reported that construction began at Merom 1 and 2. Construction was delayed at the two 490 MW units, which will utilize limestone for SO_2 removal, for most of the winter because of bad weather.

Indianapolis Power and Light awarded a contract to Research Cottrell to install a limestone FGD system with a designed SO_2 removal efficiency of 80 percent at Petersburg 4. The 530 MW unit is scheduled to start up in April 1982.

The FGD system at the La Cygne 1 generating station of Kansas City Power and Light operated with an average availability of 91 percent for the period. Boiler hours were 620 and 543 for April and May, respectively. Most of the FGD system general maintenance and repairs were accomplished during boiler outages.

The Lawrence 5 unit of Kansas City Power and Light came back online April 14 after the tie-in of the new two-module rod-deck scrubber and spray tower absorber system was completed. The system has operated without an outage since startup.

Montana Power reported that the Colstrip 1 and 2 were down for the most of the spring because of scheduled overhauls.

Nevada Power reported that availabilities ranged from 97 to 100 percent for the report period for Reid Gardner 1, 2, and 3 while reliabilities were between 96 and 100 percent.

The FGD systems at Sherburne 1 and 2 of Northern States Power demonstrated total-system availabilities of 95 and 92 percent for April. Total-system availabilities for May were 95 and 91 percent for Units 1 and 2, respectively. During April new stainless steel strainer screens were installed in two of the modules on Sherburne 1, and Module 201 on Sherburne 2 was converted for use with the new spray tower.

Philadelphia Electric reported that Eddystone 1A came back online June 1. The unit had been down since December 22, 1977, because of an extensive system modification.

South Carolina Public Service reported that construction began at 300 MW Winyah 3 on the limestone venturi/tray tower system, which is similar to the operational system at Winyah 2 with particulate removal affected by ESP's and a flue gas bypass system for reheat.

As part of a cooperative agreement between the U.S. EPA and the U.S. Bureau of Mines (USBM), a demonstration regenerable citrate FGD system is now being installed on a 50-MW coal-fired boiler at the G.F. Wheaton Station of the St. Joseph Minerals Corporation in Monaco, Pennsylvania. The citrate process, which has been developed through two separate pilot plant programs conducted by USBM and Pfizer Chemical Company, recovers the scrubbed sulfur dioxide as elemental sulfur. Although the installation site is an industrial facility, this system was added to the utility FGD survey report because the G.F. Wheaton Station is interconnected via a 25-MW interchange to the Duquesne Light Company (in addition to supplying the steam and electric load for smelting operations at the plant).

The Texas Air Control Board reported that Texas Utilities 750-MW Monticello Unit 3 became operational during the period; however, as of yet the unit has not operated at greater than a 300-MW load. The utility expects to be running at full load by the end of August.

Initial operations began at Utah Power and Light's Huntington 1 unit. Commercial operation should start sometime in July.

Table II. SUMMARY OF CHANGES: FGD SUMMARY REPORT, APRIL-MAY 1978

FGD status report	Operational		Under construction		Contract awarded		Letter of intent		Requesting/ eval. bids		Considering FGD		Total	
	No.	MW	No.	MW	No.	MW	No.	MW	No.	MW	No.	MW	No.	MW
3-31-78	34	11,447	42	17,625	17	9,073	3	892	4	2,030	32	15,307	132	56,374
Arizona Public Service Cholla 2	+1	250	-1	250										
Associated Elec. Coop Thomas Hill 3					+1	670							+1	670
Basin Electric Power Coop Antelope Valley 2			-1	455	+1	455								
Central Illinois Light Duck Creek 2									+1	400	-1	400		
Eastern Kentucky Power Coop Spurlock 2					+1	500			-1	500				
General Public Utilities Seward 7											+1	800	+1	800
Gulf Power Schols 1B & 2B			+1	20									+1	20
Hoosier Energy Merom 1			+1	490	-1	490								
Hoosier Energy Merom 2			+1	490	-1	490								
Indianapolis Power & Light Petersburg 4			+1	530					-1	530				
Public Service of N.M. San Juan 3			-1	468	+1	468								
South Carolina Public Serv. Winyah 3			+1	300	-1	300								
Southern Illinois Power Coop. Marion 5											+1	300	+1	300

(Continued)

Table II. (continued)

FGD status report	Operational		Under construction		Contract awarded		Letter of intent		Requesting/ eval. bids		Considering FGD		Total	
	No.	MW	No.	MW	No.	MW	No.	MW	No.	MW	No.	MW	No.	MW
Southwestern Electric Power					+1	720							+1	720
Henry W. Perkey 1														
St. Joe Minerals Corp.			+1	60									+1	60
G.F. Weaton 1														
Texas Power & Light									-1	545	+1	545		
Sandow 4														
Texas Utilities	+1	750	-1	750										
Monticello 3														
Utah Power and Light	+1	415	-1	415										
Huntington 1														
Totals	37	12,862	43	17,177	19	10,606	3	892	2	855	34	16,552	132	58,944

Table III. PERFORMANCE OF OPERATIONAL UNITS DURING APRIL-MAY PERIOD

Plant	FGD system design capacity	FGD unit on-line during period	No information for this period	Shutdown throughout period	FGD system availability, %		FGD system operability, %		FGD system reliability, %		FGD system utilization, %	
					Apr	May	Apr	May	Apr	May	Apr	May
Cholla 1	115	115							85			
Cholla 2	250	250										
Conesville 5	400	400			66	53	59	48	82	48	59	47
Conesville 6	400			400								
Elrama	510	310		200								
Phillips	410	410										
Petersburg 3	530	530										
Hawthorn 3	140	140			76	37						
Hawthorn 4	100	100			40	44						
La Cygne	820	820			91	91						
Lawrence 4	125	125										
Lawrence 5	400	400										
Green River 1,2, and 3	64	64			41	64	99	100	99	98	41	64
Cane Run 4	178	178					100	35			47	12
Cane Run 5	183	183										
Paddys Run 6	65	65										
M. R. Young 2	450	450										
Colstrip 1	360			360								
Colstrip 2	360			360								
Reid Gardner 1	125	125			100	97	97	92	100	96	75	78
Reid Gardner 2	125	125			100	100	98	100	100	100	44	97
Reid Gardner 3	125	125			97	97	89	77	97	96	87	66
D. H. Mitchell II	115	115			0	51			0	50	0	37
Sherburne 1	710	710			95	95						
Sherburne 2	710	710			92	91						

(continued)

Table III. (continued)

Plant	FGD system design capacity	FGD unit on-line during period	No information for this period	Shutdown throughout period	FGD system availability, %		FGD system operability, %		FGD system reliability, %		FGD system utilization, %	
					Apr	May	Apr	May	Apr	May	Apr	May
Bruce Mansfield 1	825		825									
Bruce Mansfield 2	825		825									
Eddystone 1A	120			120								
San Juan 1	314	314										
Winyah 2	280	280										
Southwest 1	200	200										
Shawnee 10A	10	10										
Shawnee 10B	10	10										
Widows Creek 8	550	550			69		83		67		62	
Martin Lake 1	793	793										
Monticello 3	750	750										
Huntington 1	415	415										
Total	12,862	9,772	1,650	1,440								

REFERENCES FOR EXECUTIVE SUMMARY

a Sixth Biennial Survey of Power Equipment Requirements of the U.S. Electric Utility Industry: 1977-1986, sponsored by the Power Equipment Div., National Electrical Manufacturers Association.

b Policy Testing Model for Electric Utilities, Exhibit II-3, Developed by Temple, Barker, and Sloane, Inc.

c 12th Annual Power Engineering Survey, Power Engineering, April 1978.

SECTION 1
SUMMARY LIST OF FGD SYSTEMS

COMPANY NAME	UNIT NAME	START UP DATE	STATUS	REG CLASS
ALABAMA ELECTRIC COOP	TUMBIGBEE 2	7-78	2	A
ALABAMA ELECTRIC COOP	TUMBIGBEE 3	6-79	2	A
ALLEGHENY POWER SYSTEM	PLEASANTS 1	3-79	2	A
ALLEGHENY POWER SYSTEM	PLEASANTS 2	3-80	2	A
ARIZONA ELECTRIC POWER COOP	APACHE 2	8-78	2	B
ARIZONA ELECTRIC POWER COOP	APACHE 3	4-79	2	B
ARIZONA PUBLIC SERVICE	CHOLLA 1	10-73	1	B
ARIZONA PUBLIC SERVICE	CHOLLA 2	6-78	1	B
ARIZONA PUBLIC SERVICE	CHOLLA 4	6-80	3	B
ARIZONA PUBLIC SERVICE	FOUR CORNERS 1	0- 0	6	B
ARIZONA PUBLIC SERVICE	FOUR CORNERS 2	0- 0	6	B
ARIZONA PUBLIC SERVICE	FOUR CORNERS 3	0- 0	6	B
ARIZONA PUBLIC SERVICE	FOUR CORNERS 4	0- 0	6	B
ARIZONA PUBLIC SERVICE	FOUR CORNERS 5	0- 0	6	B
ASSOCIATED ELECTRIC COOP	THOMAS HILL 3	0-81	3	A
BASIN ELECTRIC POWER COOP	ANTELOPE VALLEY 1	11-81	5	B
BASIN ELECTRIC POWER COOP	ANTELOPE VALLEY 2	11-83	6	B
BASIN ELECTRIC POWER COOP	LARAMIE RIVER 1	4-80	2	B
BASIN ELECTRIC POWER COOP	LARAMIE RIVER 2	10-80	2	B
BASIN ELECTRIC POWER COOP	LARAMIE RIVER 3	4-82	6	B
BIG RIVERS ELECTRIC	REID 2	12-79	2	A
BIG RIVERS ELECTRIC	REID 3	12-80	2	A
BRAZOS ELECTRIC POWER COOP	SAN MIGUEL 1	6-80	2	A
CENTRAL ILLINOIS LIGHT	DUCK CREEK 1	8-78	2	A
CENTRAL ILLINOIS LIGHT	DUCK CREEK 2	1-82	5	A
CENTRAL ILLINOIS PUBLIC SERV	NEWTON 1	11-79	2	A
CENTRAL MAINE POWER	SEARS ISLAND 1	11-86	6	A
CINCINNATI GAS & ELECTRIC	EAST BEND 2	1-81	3	A
COLORADO UTE ELECTRIC ASSN.	CRAIG 1	3-79	2	B
COLORADO UTE ELECTRIC ASSN.	CRAIG 2	3-79	2	B
COLUMBUS & SOUTHERN OHIO ELEC.	CONESVILLE 5	1-77	1	B
COLUMBUS & SOUTHERN OHIO ELEC.	CONESVILLE 6	4-78	1	B
COLUMBUS & SOUTHERN OHIO ELEC.	POSTON 5	0-83	6	B
COLUMBUS & SOUTHERN OHIO ELEC.	POSTON 6	0-85	6	B
COMMONWEALTH EDISON	POWERTON 51	3-79	2	C
COOPERATIVE POWER ASSOCIATION	COAL CREEK 1	2-79	2	A
COOPERATIVE POWER ASSOCIATION	COAL CREEK 2	11-79	2	A
DELMARVA POWER & LIGHT	DELAWARE CITY 1, 2 & 3	6-80	2	C
DUQUESNE LIGHT	ELRAMA POWER STATION	10-75	1	B
DUQUESNE LIGHT	PHILLIPS POWER STATION	7-73	1	B
EASTERN KENTUCKY POWER COOP	SPURLOCK 2	3-80	3	A
GENERAL PUBLIC UTILITIES	COHO 1	5-87	6	A
GENERAL PUBLIC UTILITIES	SEWARD 7	5-84	6	A
GULF POWER	CRIST 4 & 5	0- 0	7	B
GULF POWER	CRIST 6 & 7	0-80	7	B
GULF POWER	LANSING SMITH 1 & 2	0-80	7	B
GULF POWER	SCHOLZ NOS. 1B & 2B	8-78	2	C
HOOSIER ENERGY	MEROM 1	12-80	2	A
HOOSIER ENERGY	MEROM 2	10-81	2	A
INDIANAPOLIS POWER & LIGHT	PETERSBURG 3	10-77	1	A
INDIANAPOLIS POWER & LIGHT	PETERSBURG 4	4-82	2	A
KANSAS CITY POWER & LIGHT	HAWTHORN 3	11-72	1	B
KANSAS CITY POWER & LIGHT	HAWTHORN 4	8-72	1	B
KANSAS CITY POWER & LIGHT	LA CYGNE 1	2-73	1	C
KANSAS POWER & LIGHT	JEFFEREY 1	6-78	2	B
KANSAS POWER & LIGHT	JEFFEREY 2	6-80	2	B
KANSAS POWER & LIGHT	LAWRENCE 4	12-68	1	B
KANSAS POWER & LIGHT	LAWRENCE 5	11-71	1	B
KENTUCKY UTILITIES	GREEN RIVER 1,2 & 3	9-75	1	C
LAKELAND UTILITIES	MCINTOSH 3	10-81	3	A

1. OPERATIONAL UNITS
2. UNITS UNDER CONSTRUCTION
3. PLANNED - CONTRACT AWARDED
4. PLANNED - LETTER OF INTENT SIGNED
5. PLANNED - REQUESTING/EVALUATING BIDS
6. CONSIDERING ONLY FGD SYSTEMS
7. CONSIDERING FGD SYSTEMS AS WELL AS ALTERNATIVE METHODS

A. BOILER CONSTRUCTED SUBJECT TO FEDERAL NSPS
B. BOILER SUBJECT TO STATE STANDARD THAT IS MORE STRINGENT THAN THE FEDERAL NSPS
C. BOILER SUBJECT TO STATE STANDARD THAT IS EQUAL TO OR LESS STRINGENT THAN NSPS
D. OTHER
E. REGULATORY CLASS UNKNOWN

SECTION 1
SUMMARY LIST OF FGD SYSTEMS

COMPANY NAME	UNIT NAME	START UP DATE	STATUS	REG CLASS
LOUISVILLE GAS & ELECTRIC	CANE RUN 4	8-76	1	B
LOUISVILLE GAS & ELECTRIC	CANE RUN 5	12-77	1	B
LOUISVILLE GAS & ELECTRIC	CANE RUN 6	12-78	2	B
LOUISVILLE GAS & ELECTRIC	MILL CREEK 1	1-82	6	B
LOUISVILLE GAS & ELECTRIC	MILL CREEK 2	1-81	6	B
LOUISVILLE GAS & ELECTRIC	MILL CREEK 3	7-78	2	B
LOUISVILLE GAS & ELECTRIC	MILL CREEK 4	6-80	2	B
LOUISVILLE GAS & ELECTRIC	PADDYS RUN 6	4-73	1	C
MINNESOTA POWER & LIGHT	CLAY BOSWELL 4	5-80	2	A
MINNKOTA POWER COOPERATIVE	MILTON R. YOUNG 2	9-77	1	B
MONTANA POWER	COLSTRIP 1	11-75	1	A
MONTANA POWER	COLSTRIP 2	87-60	1	A
MONTANA POWER	COLSTRIP 3	7-80	3	B
MONTANA POWER	COLSTRIP 4	7-81	3	B
NEVADA POWER	HARRY ALLEN 1	6-83	6	A
NEVADA POWER	HARRY ALLEN 2	6-84	6	A
NEVADA POWER	HARRY ALLEN 3	6-85	6	A
NEVADA POWER	HARRY ALLEN 4	6-86	6	A
NEVADA POWER	REID GARDNER 1	4-74	1	A
NEVADA POWER	REID GARDNER 2	4-74	1	A
NEVADA POWER	REID GARDNER 3	7-76	1	A
NEVADA POWER	REID GARDNER 4	0- 0	4	A
NEVADA POWER	WARNER VALLEY 1	6-82	6	A
NEVADA POWER	WARNER VALLEY 2	6-83	6	A
NEW ENGLAND ELEC SYSTEM	BRAYTON POINT 3	0- 0	6	C
NIAGARA MOHAWK POWER COOP	CHARLES R. HUNTLEY 6	0-80	3	C
NORTHERN INDIANA PUB SERVICE	BAILLY 7	0- 0	6	C
NORTHERN INDIANA PUB SERVICE	BAILLY 8	0- 0	6	C
NORTHERN INDIANA PUB SERVICE	DEAN H. MITCHELL 11	11-76	1	C
NORTHERN STATES POWER	SHERBURNE 1	3-76	1	B
NORTHERN STATES POWER	SHERBURNE 2	4-77	1	B
NORTHERN STATES POWER	SHERBURNE 3	5-81	3	B
NORTHERN STATES POWER	SHERBURNE 4	5-83	3	B
OTTER TAIL POWER	COYOTE 1	5-81	3	B
PACIFIC GAS AND ELECTRIC	FOSSIL 1	0-84	6	B
PACIFIC GAS AND ELECTRIC	FOSSIL 2	0-85	6	B
PACIFIC POWER & LIGHT	JIM BRIDGER 4	9-79	2	B
PENNSYLVANIA POWER	BRUCE MANSFIELD 1	4-76	1	B
PENNSYLVANIA POWER	BRUCE MANSFIELD 2	7-77	1	B
PENNSYLVANIA POWER	BRUCE MANSFIELD 3	4-80	3	B
PHILADELPHIA ELECTRIC	CROMBY	6-80	6	B
PHILADELPHIA ELECTRIC	EDDYSTONE 1A	9-75	1	B
PHILADELPHIA ELECTRIC	EDDYSTONE 1B	6-80	4	B
PHILADELPHIA ELECTRIC	EDDYSTONE 2	6-80	6	B
POTOMAC ELECTRIC POWER	DICKERSON 4	5-85	7	D
POWER AUTHORITY OF NEW YORK	ARTHUR KILL PLANT	11-84	7	B
PUBLIC SERVICE OF INDIANA	GIBSON 5	0-82	6	A
PUBLIC SERVICE OF NEW MEXICO	SAN JUAN 1	4-78	1	B
PUBLIC SERVICE OF NEW MEXICO	SAN JUAN 2	7-78	2	B
PUBLIC SERVICE OF NEW MEXICO	SAN JUAN 3	1-81	3	B
PUBLIC SERVICE OF NEW MEXICO	SAN JUAN 4	1-82	6	B
SALT RIVER PROJECT	CORONADO 1	4-79	2	B
SALT RIVER PROJECT	CORONADO 2	4-80	2	B
SALT RIVER PROJECT	CORONADO 3	0-87	6	B
SIKESTON BOARD OF MUNIC. UTIL.	SIKESTON POWER STATION	6-81	2	A
SOUTH CAROLINA PUBLIC SERVICE	WINYAH 2	7-77	1	A
SOUTH CAROLINA PUBLIC SERVICE	WINYAH 3	5-80	2	A
SOUTHERN ILLINOIS POWER COOP	MARION 4	8-78	2	A
SOUTHERN ILLINOIS POWER COOP	MARION 5	0-84	6	A
SOUTHERN INDIANA GAS & ELEC	A. B. BROWN 1	4-79	2	A

1. OPERATIONAL UNITS
2. UNITS UNDER CONSTRUCTION
3. PLANNED - CONTRACT AWARDED
4. PLANNED - LETTER OF INTENT SIGNED
5. PLANNED - REQUESTING/EVALUATING BIDS
6. CONSIDERING ONLY FGD SYSTEMS
7. CONSIDERING FGD SYSTEMS AS WELL AS ALTERNATIVE METHODS

A. BOILER CONSTRUCTED SUBJECT TO FEDERAL NSPS
B. BOILER SUBJECT TO STATE STANDARD THAT IS MORE STRINGENT THAN THE FEDERAL NSPS
C. BOILER SUBJECT TO STATE STANDARD THAT IS EQUAL TO OR LESS STRINGENT THAN NSPS
D. OTHER
E. REGULATORY CLASS UNKNOWN

SECTION 1
SUMMARY LIST OF FGD SYSTEMS

COMPANY NAME	UNIT NAME	START UP DATE	STATUS	REG CLASS
SOUTHERN MISSISSIPPI ELECTRIC	R. D. MORROW 1	8-78	2	A
SOUTHERN MISSISSIPPI ELECTRIC	R. D. MORROW 2	10-78	2	A
SOUTHWESTERN ELECTRIC POWER	HENRY W. PERKEY 1	6-83	3	A
SPRINGFIELD CITY UTILITIES	SOUTHWEST 1	4-77	1	A
SPRINGFIELD WATER LIGHT & PWR	DALLMAN 3	7-80	3	A
ST. JOE MINERALS CORP.	G. F. WEATON 1	10-78	2	B
TENNESSEE VALLEY AUTHORITY	SHAWNEE 10A	4-72	1	C
TENNESSEE VALLEY AUTHORITY	SHAWNEE 10B	4-72	1	C
TENNESSEE VALLEY AUTHORITY	WIDOWS CREEK 7	0- 0	3	C
TENNESSEE VALLEY AUTHORITY	WIDOWS CREEK 8	5-77	1	C
TEXAS MUNICIPAL POWER AGENCY	GIBBONS CREEK 1	1-82	3	A
TEXAS POWER & LIGHT	SANDOW 4	7-80	3	A
TEXAS POWER & LIGHT	TWIN OAKS 1	8-83	6	A
TEXAS POWER & LIGHT	TWIN OAKS 2	9-84	6	A
TEXAS UTILITIES	FOREST GROVE 1	0-81	6	A
TEXAS UTILITIES	MARTIN LAKE 1	8-77	1	A
TEXAS UTILITIES	MARTIN LAKE 2	5-78	2	A
TEXAS UTILITIES	MARTIN LAKE 3	12-78	2	A
TEXAS UTILITIES	MARTIN LAKE 4	11-82	3	A
TEXAS UTILITIES	MONTICELLO 3	5-78	1	A
UTAH POWER & LIGHT	EMERY 1	12-78	2	A
UTAH POWER & LIGHT	HUNTINGTON 1	5-78	1	A
VIRGINIA ELECTRIC & POWER	MT. STORM	0- 0	7	C
WISCONSIN POWER & LIGHT	COLUMBIA 2	1-80	4	A

1. OPERATIONAL UNITS
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E. REGULATORY CLASS UNKNOWN

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
ALABAMA ELECTRIC COOP TOMBIGBEE 2 225 MW - NEW COAL 0.8 - 1.5 PERCENT SULFUR PEABODY ENGINEERING LIMESTONE STARTUP 7/78	PEABODY ENGINEERING HAS BEEN AWARDED THE CONTRACT FOR THE INSTALLATION OF A LIMESTONE FGD SYSTEM ON THIS UNIT. A HIGH-EFFICIENCY ESP WILL BE INSTALLED UPSTREAM OF THE FGD SYSTEM TO PROVIDE PRIMARY PARTICULATE CONTROL. THE FGD SYSTEM CONTAINS TWO SCRUBBING TRAINS, TREATING APPROXIMATELY 70 PERCENT OF THE FLUE GAS FOR REMOVAL OF SULFUR DIOXIDE. STACK GAS REHEAT WILL NOT BE REQUIRED. COST INFORMATION IS REPORTED IN APPENDIX A. CURRENTLY, ERECTION OF THE SCRUBBING EQUIPMENT IS NOW IN FINAL PHASE.
ALABAMA ELECTRIC COOP TOMBIGBEE 3 225 MW - NEW COAL 0.8 - 1.5 PERCENT SULFUR PEABODY ENGINEERING LIMESTONE STARTUP 6/79	PEABODY ENGINEERING HAS BEEN AWARDED THE CONTRACT FOR THE INSTALLATION OF A LIMESTONE FGD SYSTEM ON THIS UNIT. A HIGH-EFFICIENCY ESP WILL BE INSTALLED UPSTREAM OF THE FGD SYSTEM TO PROVIDE PRIMARY PARTICULATE CONTROL. THE FGD SYSTEM CONSISTS OF TWO TRAINS, TOGETHER TREATING APPROXIMATELY 70 PERCENT OF THE FLUE GAS FOR REMOVAL OF SULFUR DIOXIDE. STACK GAS REHEAT WILL NOT BE REQUIRED. CONSTRUCTION ON THE UNIT 3 TURBINE AND BOILER HAS BEGUN AND IS 30 TO 40 PERCENT COMPLETE.
ALLEGHENY POWER SYSTEM PLEASANTS 1 625 MW - NEW COAL 4.5 PERCENT SULFUR (MAX) BABCOCK & WILCOX LIME STARTUP 3/79	THE THREE PRINCIPAL OPERATING UTILITY COMPANIES OF THE ALLEGHENY POWER SYSTEM ARE INSTALLING AN EMISSION CONTROL SYSTEM FOR THIS NEW COAL-FIRED UNIT WHICH INCLUDES A HIGH EFFICIENCY ESP UPSTREAM OF FOUR TRAY TOWERS FOR THE CONTROL OF PARTICULATES AND SULFUR DIOXIDE. DESIGN REMOVAL EFFICIENCIES FOR THIS EMISSION CONTROL SYSTEM ARE 99.5 AND 90 PERCENT RESPECTIVELY. THE DRAVO CO. IS SUPPLYING THIOSORBIC LIME. THE CONSULTING ENGINEERING FIRM IS UNITED ENGINEERS AND CONSTRUCTORS. CURRENTLY, ERECTION OF THE SCRUBBING EQUIPMENT IS IN PROGRESS.
ALLEGHENY POWER SYSTEM PLEASANTS 2 625 MW - NEW COAL 4.5 PERCENT SULFUR (MAX) BABCOCK & WILCOX LIME STARTUP 3/80	THE THREE PRINCIPAL OPERATING UTILITY COMPANIES OF THE ALLEGHENY POWER SYSTEM ARE INSTALLING AN EMISSION CONTROL SYSTEM FOR THIS NEW COAL-FIRED UNIT WHICH INCLUDES A HIGH EFFICIENCY ESP UPSTREAM OF FOUR TRAY TOWERS FOR THE CONTROL OF PARTICULATES AND SULFUR DIOXIDE. DESIGN REMOVAL EFFICIENCIES FOR THIS EMISSION CONTROL SYSTEM ARE 99.5 AND 90 PERCENT, RESPECTIVELY. THE DRAVO CO. IS SUPPLYING THIOSORBIC LIME. THE CONSULTING ENGINEERING FIRM IS UNITED ENGINEERS AND CONSTRUCTORS. CURRENTLY, FOUNDATION WORK ON THE SCRUBBER PLANT IS IN PROGRESS.
ARIZONA ELECTRIC POWER COOP APACHE 2 200 MW - NEW COAL 0.5- 0.8 PERCENT SULFUR RESEARCH COTTRELL LIMESTONE STARTUP 8/78	AEPC HAS AWARDED A CONTRACT TO RESEARCH COTTRELL FOR A LIMESTONE FGD SYSTEM. THE UNIT WILL FIRE BITUMINOUS COAL WITH A SULFUR CONTENT OF 0.5-0.8% AND ASH CONTENT OF 10.0% (HEATING VALUE - 10,000-11,000BTU/LB). THERE IS A 22 ACRE SLUDGE POND AND A 64 ACRE ASH POND. PONDS WILL BE UNLINED AND 10 FEET DEEP. THERE WILL BE NO REHEAT. CONSTRUCTION OF THE SYSTEM IS NEARLY COMPLETE AND ALL FGD EQUIPMENT IS INSTALLED. SCRUBBER LINING IS COMPLETE. THE PLASTIC GIRDERS SUPPORTING THE MIST ELIMINATORS WERE REPLACED WITH STEEL GIRDERS. ELECTRICAL WORK CONTINUES.
ARIZONA ELECTRIC POWER COOP APACHE 3 200 MW - NEW COAL 0.5- 0.8 PERCENT SULFUR RESEARCH COTTRELL LIMESTONE STARTUP 4/79	STRUCTURAL STEELWORK FOR HOT-SIDE UOP ESP'S IS COMPLETE. STRUCTURE ERECTION OF THE SCRUBBER-ABSORBER TOWERS IS COMPLETE. EACH SCRUBBER CAN HANDLE 400,000 ACFM @ 270 F AND RECIRCULATE 20,000 GPM OF SLURRY. BOILER CONSTRUCTION HAS BEGUN. THERE ARE CURRENTLY 2 PONDS WITH A TOTAL OF 20-YRS CAPACITY FOR THE DISPOSAL OF THE UNFIXATED SLUDGE. 2 ADDITIONAL PONDS ARE PLANNED PROVIDING AN ADDITIONAL 20 YRS OF DISPOSAL CAPABILITY. THERE WILL BE NO REHEAT. BECAUSE OF THE HIGH COST OF THE UNIT 2 STACK LINER, UNIT 3 WILL NOT USE THE CXL2000 MATERIAL USED IN UNIT 2.
ARIZONA PUBLIC SERVICE CHOLLA 1 115 MW - RETROFIT COAL 0.44-1 PERCENT SULFUR RESEARCH COTTRELL LIMESTONE STARTUP 10/73	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS LIMESTONE SCRUBBING SYSTEM WAS PLACED IN SERVICE IN OCTOBER 1973. THE SCRUBBER PLANT CONSISTS OF TWO PARALLEL SCRUBBING TRAINS. PARTICULATE CONTROL IS PROVIDED BY TWO FLOODED-DISC SCRUBBERS. SO2 CONTROL IS PROVIDED BY ONE PACKED (MUNTERS PACKING) TOWER (A-SIDE). FLUE GAS CLEANING WASTES ARE DISCHARGED TO AN EXISTING FLY ASH POND. NO WATER IS RECYCLED BACK FROM THE DISPOSAL POND. IN-LINE STEAM REHEATERS RAISE THE GAS TEMPERATURE 40 F.
ARIZONA PUBLIC SERVICE CHOLLA 2 250 MW - NEW COAL 0.44-1 PERCENT SULFUR RESEARCH COTTRELL LIMESTONE STARTUP 6/78	THE CONTRACT FOR THIS WET LIMESTONE SCRUBBING SYSTEM HAS BEEN AWARDED BY THE UTILITY TO RESEARCH-COTTRELL. THERE ARE MECHANICAL COLLECTORS FOR PRIMARY PARTICULATE REMOVAL. ALL DESIGN AND ENGINEERING WORK HAS BEEN COMPLETED. CONSTRUCTION OF THE UNIT IS NOW COMPLETE AND CAN BE CONSIDERED OPERATIONAL. THE FGD SYSTEM CONSISTS OF FOUR PARALLEL FLOODED-DISC AND PACKED TOWER ABSORBER TRAINS. THREE ARE REQUIRED FOR FULL LOAD CAPACITY. INITIAL BOILER START-UP BEGAN FEBRUARY 1978. FULL COMMERCIAL OPERATIONS SHOULD OCCUR BY AUGUST 1978.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
ARIZONA PUBLIC SERVICE CHOLLA 4 350 MW - NEW COAL 0.44-1 PERCENT SULFUR RESEARCH COTTRELL LIMESTONE STARTUP 6/80	UNIT NO. 4 IS CURRENTLY UNDER CONSTRUCTION. APS HAS AWARDED THE FGD CONTRACT TO RESEARCH COTTRELL. THE STATE REGULATORY AGENCY HAS NOT YET DECIDED THE EMISSIONS REGULATIONS WHICH WILL APPLY TO THE PLANT. THE C-E BOILER WILL FIRE THE SAME COAL AS CHOLLA NO. 1, WITH SULFUR CONTENT OF 0.44-1.0 PERCENT. THE A-E FIRM IS EBASCO. COMMERCIAL START-UP IS SLATED FOR 06/80. THE FGD SYSTEM IS A DOUBLE LOOP LIMESTONE ABSORPTION PROCESS AND REVENUES OF THE CONTRACT TO R-C ARE REPORTED TO BE 55 MM. FOR CONTROL OF PARTICULATE AN ESP WILL HANDLE 100% OF THE FLUE GAS.
ARIZONA PUBLIC SERVICE FOUR CORNERS 1 175 MW - RETROFIT COAL 0.75 PERCENT SULFUR CHEMICO/APS LIME/ALKALINE FLYASH STARTUP 0/ 0	APS WILL BE UPGRADING THE OPERATIONAL PARTICULATE SCRUBBERS AT THE FOUR CORNERS 1, 2 AND 3 FOR ADDITIONAL SO2 REMOVAL. CURRENTLY, EACH UNIT HAS 2 CHEMICO VENTURI SCRUBBER MODULES FOR PARTICULATE CONTROL. ROUGHLY 30% OF THE FLUE GAS SO2 CONTENT IS REMOVED AT THE PRESENT TIME IN THE VENTURIS WITH THE HIGH ALKALINE FLYASH. NEW MEXICO APC OFFICALS INDICATED THAT THE 5 FOUR CORNERS UNITS WILL BE REQUIRED TO REMOVE AT LEAST 67.5% OF THE STATION SO2 (ALL 5 UNITS CONSIDERED TOGETHER). ADDITIONAL ALKALINITY WILL BE IMPARTED TO THE SCRUBBING SOLUTION BY ADDING LIME.
ARIZONA PUBLIC SERVICE FOUR CORNERS 2 175 MW - RETROFIT COAL 0.75 PERCENT SULFUR CHEMICO/APS LIME/ALKALINE FLYASH STARTUP 0/ 0	APS WILL BE UPGRADING THE OPERATIONAL PARTICULATE SCRUBBERS AT THE FOUR CORNERS UNIT NOS. 1, 2 AND 3 FOR ADDITIONAL SO2 REMOVAL. EACH UNIT HAS 2 CHEMICO VENTURI SCRUBBER MODULES FOR PARTICULATE CONTROL. ROUGHLY 30% OF THE FLUE GAS SO2 CONTENT IS REMOVED AT THE PRESENT TIME IN THE VENTURIS WITH THE HIGH ALKALINE FLYASH. NEW MEXICO APC OFFICALS INDICATED THAT THE 5 FOUR CORNERS UNITS WILL BE REQUIRED TO REMOVE AT LEAST 67.5% OF THE STATION SO2 (ALL 5 UNITS, CONSIDERED TOGETHER). ADDITONAL ALKALINITY WILL BE IMPARTED TO THE SCRUBBING SOLUTION BY ADDING LIME.
ARIZONA PUBLIC SERVICE FOUR CORNERS 3 229 MW - RETROFIT COAL 0.75 PERCENT SULFUR CHEMICO/APS LIME/ALKALINE FLYASH STARTUP 0/ 0	APS WILL BE UPGRADING THE OPERATIONAL PARTICULATE SCRUBBERS AT THE FOUR CORNERS UNIT NOS. 1, 2 AND 3 FOR ADDITIONAL SO2 REMOVAL. EACH UNIT HAS 2 CHEMICO VENTURI SCRUBBER MODULES FOR PARTICULATE CONTROL. ROUGHLY 30% OF THE FLUE GAS SO2 CONTENT IS REMOVED AT THE PRESENT TIME IN THE VENTURIS WITH THE HIGH ALKALINE FLYASH. NEW MEXICO APC OFFICALS INDICATED THAT THE 5 FOUR CORNERS UNITS WILL BE REQUIRED TO REMOVE AT LEAST 67.5% OF THE STATION SO2 (ALL 5 UNITS CONSIDERED TOGETHER). ADDITIONAL ALKALINITY WILL BE IMPARTED TO THE SCRUBBING SOLUTION BY ADDING LIME.
ARIZONA PUBLIC SERVICE FOUR CORNERS 4 755 MW - RETROFIT COAL 0.7 PERCENT SULFUR VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 0/ 0	THE UTILITY IS CURRENTLY EVALUATING THE DATA AND INFORMATION ACCUMULATED DURING THE HORIZONTAL PROTOTYPE SCRUBBING PROGRAM IN ORDER TO ASCERTAIN VARIOUS POSSIBLE STRATEGIES TO CONTROL THE EMISSIONS FROM THIS COAL FIRED 755-MW UNIT. APS WILL BE REQUIRED TO REDUCE THE CURRENT LEVEL OF SO2 EMISSIONS FROM THE ENTIRE PLANT BY INCREASING THE REMOVAL EFFICIENCY TO AT LEAST 67.5%. A DECISION ON THE USE OF FGD FOR THIS UNIT WILL BE ANNOUNCED SHORTLY.
ARIZONA PUBLIC SERVICE FOUR CORNERS 5 755 MW - RETROFIT COAL 0.7 PERCENT SULFUR VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 0/ 0	THE UTILITY IS CURRENTLY EVALUATING THE DATA AND INFORMATION ACCUMULATED DURING THE HORIZONTAL PROTOTYPE SCRUBBING PROGRAM IN ORDER TO ASCERTAIN VARIOUS POSSIBLE STRATEGIES TO CONTROL THE EMISSIONS FROM THIS COAL-FIRED 755-MW UNIT. A DECISION, PENDING THE OUTCOME OF LOCAL REGULATORY AGENCY HEARINGS, WILL BE ANNOUNCED IN THE NEAR FUTURE.
ASSOCIATED ELECTRIC COOP THOMAS HILL 3 670 MW - NEW COAL 4.8 PERCENT SULFUR PULLMAN KELLOGG LIMESTONE STARTUP 0/81	ASSOCIATED ELECTRIC COOP AWARDED A CONTRACT TO PULLMAN KELLOGG FOR THE ENGINEERING, PROCUREMENT AND CONSTRUCTION OF AN FGD SYSTEM ON THE UTILITY'S THOMAS HILL UNIT NO. 3 POWER PLANT. SO2 REMOVAL EQUIPMENT WILL OPERATE IN CONJUNCTION WITH A HIGH EFFICIENCY ESP. THE SYSTEM, SCHEDULED FOR START-UP IN 1981, WILL UTILIZE MAGNESIUM-PROMOTED LIMESTONE AS A REAGENT IN THE WEIR FGD SYSTEM.
BASIN ELECTRIC POWER COOP ANTELOPE VALLEY 1 455 MW - NEW LIGNITE 0.68 PERCENT SULFUR VENDOR NOT SELECTED LIME STARTUP 11/81	THE UTILITY HAS CURRENTLY SELECTED A LIME SCRUBBING PROCESS FOR THEIR PLANNED FGD SYSTEM. THE UNIT WILL FIRE LIGNITE COAL WITH A SULFUR CONTENT OF 0.68 PERCENT AND AN ASH CONTENT OF 8.0 PERCENT (6600 BTU/LB). THE WATER LOOP WILL BE OPEN WITH MAKE-UP COMING FROM COOLING TOWER BLOWDOWN. THE SLUDGE WILL BE DISPOSED IN A MINE LANDFILL. THIS UNIT WILL BE REQUIRED TO MEET WITH THE STATE EMISSION STANDARDS. THE UTILITY IS CURRENTLY REQUESTING BIDS.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
BASIN ELECTRIC POWER COOP ANTELOPE VALLEY 2 455 MW - NEW LIGNITE 0.68 PERCENT SULFUR VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 11/83	THE UTILITY IS CURRENTLY INVESTIGATING VARIOUS FGD PROCESSES FOR THIS SECOND LIGNITE-FIRED UNIT SCHEDULED AT THE NEW STATION LOCATED IN MERCER COUNTY, NEAR BEULAH, NORTH DAKOTA. THIS NEW FACILITY WILL BE KNOWN AS THE ANTELOPE VALLEY STATION AND WILL BE REQUIRED TO COMPLY WITH STATE AIR EMISSION STANDARDS VIA THE BEST AVAILABLE TECHNOLOGY. START-UP IS NOW SCHEDULED FOR NOVEMBER 1983. BIDS ARE EXPECTED TO GO OUT THIS SUMMER.
BASIN ELECTRIC POWER COOP LARAMIE RIVER 1 570 MW - NEW COAL 0.8 PERCENT SULFUR RESEARCH COTTRELL LIMESTONE STARTUP 4/80	RESEARCH-COTTRELL IS CURRENTLY FABRICATING THE DUAL-LOOP LIMESTONE WET SCRUBBERS. ON-SITE CONSTRUCTION COMMENCED IN JANUARY 1978. SLUDGE WILL BE DEWATERED TO 83% SOLIDS BEFORE LANDFILL. THE SCRUBBERS WILL BE MADE OF STAINLESS STEEL AND WILL HANDLE 2.3 MM ACFM AT 286 F. L/G RATIO WILL BE 60. REFER TO APPENDIX A FOR COST INFORMATION. B&W HAS BEEN AWARDED THE CONTRACT FOR TWO ESP'S. CONSTRUCTION IS NOW 10 PERCENT COMPLETE.
BASIN ELECTRIC POWER COOP LARAMIE RIVER 2 570 MW - NEW COAL 0.8 PERCENT SULFUR RESEARCH COTTRELL LIMESTONE STARTUP 10/80	RESEARCH-COTTRELL IS CURRENTLY FABRICATING THE DUAL-LOOP LIMESTONE WET SCRUBBERS. ON-SITE CONSTRUCTION COMMENCED IN JANUARY 1978. SLUDGE WILL BE DEWATERED TO 83% SOLIDS BEFORE LANDFILL. THE SCRUBBERS WILL BE MADE OF STAINLESS STEEL AND WILL HANDLE 2.3 MM ACFM AT 286 F. L/G RATIO WILL BE REFER TO APPENDIX A FOR COST INFORMATION. B&W HAS BEEN AWARDED THE CONTRACT FOR TWO ESP'S. CONSTRUCTION IS NOW 10 PERCENT COMPLETE.
BASIN ELECTRIC POWER COOP LARAMIE RIVER 3 550 MW - NEW COAL 0.8 PERCENT SULFUR VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 4/82	THE UTILITY IS STILL CONSIDERING VARIOUS FGD PROCESSES. LARAMIE RIVER STATION WILL FIRE SUB-BITUMINOUS COAL WITH THE FOLLOWING CHARACTERISTICS: 8100 BTU/LB, 0.8 PERCENT SULFUR AND 7.0 PERCENT ASH.
BIG RIVERS ELECTRIC REID 2 250 MW - NEW COAL 3.5-4.0 PERCENT SULFUR AMERICAN AIR FILTER LIME STARTUP 12/79	THE EMISSION CONTROL SYSTEM FOR THIS NEW COAL-FIRED UNIT IS BEING SUPPLIED BY AMERICAN AIR FILTER. THE SYSTEM WILL CONSIST OF A COLD-SIDE ESP AND TWO SPRAY TOWERS CONTROLLING PARTICULATE AND SO2 TO 99.6 PERCENT AND 90 PERCENT, RESPECTIVLEY. THE B&W BOILER WILL FIRE HIGH SULFUR (3.5 TO 4.5 PERCENT) WESTERN KENTUCKY COAL. CONSTRUCTION IS NOW 58 PERCENT COMPLETE ON THE BOILER AND 15 PERCENT COMPLETE ON THE SCRUBBER. THE DESIGN INCLUDES AN INDIRECT HOT AIR REHEAT SYSTEM. IUCS WILL CONSTRUCT A SLUDGE DISPOSAL SYSTEM TO SERVICE BOTH REID 2 AND 3.
BIG RIVERS ELECTRIC REID 3 240 MW - NEW COAL 3.5-4.0 PERCENT SULFUR AMERICAN AIR FILTER LIME STARTUP 12/80	THE EMISSION CONTROL SYSTEM FOR THIS NEW COAL-FIRED UNIT IS BEING SUPPLIED BY AMERICAN AIR FILTER. THE SYSTEM WILL CONSIST OF A COLD-SIDE ESP AND TWO SPRAY TOWERS CONTROLLING PARTICULATE AND SO2 TO 99.6 PERCENT AND 90 PERCENT, RESPECTIVELY. THE B&W BOILER WILL FIRE HIGH SULFUR (3.5 TO 4.5 PERCENT) WESTERN KENTUCKY COAL. THE FGD SYSTEM WILL INCLUDE AN INDIRECT HOT AIR REHEAT SYSTEM. IUCS WILL CONSTRUCT A SLUDGE DISPOSAL SYSTEM TO SERVICE BOTH REID 2 AND 3. THE BOILER IS CURRENTLY UNDER CONSTRUCTION. SCRUBBER CONSTRUCTION WILL BEGIN IN JULY, '78.
BRAZOS ELECTRIC POWER COOP SAN MIGUEL 1 400 MW - NEW LIGNITE 1.67 PERCENT SULFUR BABCOCK & WILCOX LIMESTONE STARTUP 6/80	THE EMISSION CONTROL EQUIPMENT FOR THE COAL-FIRED RADIANT BOILER WILL CONSIST OF AN ESP UPSTREAM OF FOUR LIMESTONE SCRUBBING MODULES. THE SCRUBBER FLUE GAS CAPACITY IS NOMINALLY DESIGNED AT 1.579 MILLION ACFM (302 F). DESIGN SO2 REMOVAL EFFICIENCY IS 86 PERCENT FOR 4400 PPM SO2 INLET. L/G RATIOS ARE 10 AND 45 FOR QUENCHER AND ABSORBER, RESPECTIVELY. RESEARCH COTTRELL HAS BEEN AWARDED THE SLUDGE DISPOSAL CONTRACT. FGD SYSTEM FOUNDATION IS COMPLETE WITH STRUCTURAL STEEL ABOUT 90% ERECTED. BOILER CONSTRUCTION IS ABOUT 15% COMPLETE.
CENTRAL ILLINOIS LIGHT DUCK CREEK 1 400 MW - NEW COAL 2.5 - 3.0 PERCENT SULFUR RILEY STOKER / ENVIRONEERING LIMESTONE STARTUP 8/78	CONSTRUCTION OF THE FOUR VENTRI-SORBER MODULES BY RILEY STOKER IS ON SCHEDULE. SCRUBBER TANKS AND PUMPS WILL BE NEOPRENE LINED. THE FIRST LIMESTONE SLURRY SCRUBBER MODULE WAS PLACED IN SERVICE ON SEPTEMBER 9, 1976, AND OPERATED INTERMITTENTLY UNTIL APRIL 1, 1977. A HIGH EFFICIENCY ESP IS INSTALLED UPSTREAM OF FOUR VENTURI-SORBER SCRUBBER MODULES FOR PARTICULATE CONTROL. CONCRETE STACK IS LINED WITH CEILCOTE FLAKELINE 151. NO REHEAT PLANNED. DESIGN PARTICULATE AND SULFUR DIOXIDE REMOVAL EFFICIENCIES ARE 99.8 AND 85 PERCENT, RESPECTIVELY.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
CENTRAL ILLINOIS LIGHT DUCK CREEK 2 400 MW - NEW COAL 2.5-3.0 PERCENT SULFUR VENDOR NOT SELECTED LIMESTONE STARTUP 1/82	THE SCRUBBING UNIT IS SCHEDULED TO COMMENCE OPERATIONS IN JANUARY 1982. THE UTILITY HAS NOT YET SELECTED A SYSTEM SUPPLIER. A DECISION CONCERNING THE STATUS OF THE BOILER AND CONTROL STRATEGY WILL BE ANNOUNCED IN MID 1978. THE UTILITY WILL USE ESP'S FOR PARTICULATE CONTROL AND EITHER LIMESTONE OR DUAL ALKALI FOR SO2 SCRUBBING. THE UTILITY IS NOW IN THE PROCESS OF TAKING BIDS.
CENTRAL ILLINOIS PUBLIC SERV NEWTON 1 575 MW - NEW COAL 4.0 PERCENT SULFUR BUELL/ENVIROTECH DOUBLE ALKALI STARTUP 11/79	A CONTRACT HAS BEEN AWARDED BY CIPSCO TO BUELL/ENVIROTECH FOR THE INSTALLATION OF AN EMISSION CONTROL SYSTEM ON UNIT NO. 1. THE KEY COMPONENTS OF THE EMISSION CONTROL SYSTEM INCLUDE: A HIGH-EFFICIENCY ESP; FOUR PRECOOLERS, FOUR POLYSPHERE ABSORBERS, THREE THICKENERS, TWO EXPERIMENTAL REHEAT SYSTEMS, AND THREE HORIZONTAL EXTRACTION FILTERS FOR SLUDGE DEWATERING. APPROXIMATELY 45 PERCENT OF THE CONSTRUCTION WORK AT THE PLANT HAS BEEN COMPLETED. THE FGD SYSTEM WILL HAVE CEILCOTE-LINED ABSORBER MODULES.
CENTRAL MAINE POWER SEARS ISLAND 1 600 MW - NEW COAL SOURCE UNDETERMINED VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 11/86	BECAUSE OF THE DISCOVERY OF A GEOLOGICAL FAULT ON SEARS ISLAND, THE UTILITY HAS CANCELLED PLANS FOR A 1150-MW NUCLEAR POWER PLANT. A 600-MW COAL-FIRED UNIT IS NOW BEING PLANNED IN ITS PLACE. COMMERCIAL OPERATION IS PROJECTED FOR NOVEMBER 1986. COMPLIANCE WITH SO2 NSPS WILL BE ACHIEVED BY INSTALLING AN FGD SYSTEM. LIME AND LIMESTONE SCRUBBING PROCESSES ARE BEING GIVEN PRIMARY CONSIDERATION. CURRENTLY, CMPCO HAS FILED AN APPLICATION WITH THE STATE PUBLIC UTILITIES COMMISSION. AN ENVIRONMENTAL PERMIT APPLICATION WILL BE FILED WITHIN THE NEXT TWO YEARS.
CINCINNATI GAS & ELECTRIC EAST BEND 2 600 MW - NEW COAL BABCOCK & WILCOX LIME STARTUP 1/81	A CONTRACT HAS BEEN CONDITIONALLY AWARDED TO BABCOCK AND WILCOX FOR A COMMERCIAL LIME SCRUBBING SYSTEM. A COAL SOURCE HAS BEEN OBTAINED AND WILL BE A MID-WESTERN COAL AND IS EXPECTED TO HAVE A HIGH SULFUR CONTENT. THERE WILL BE A DRY SLUDGE DISPOSAL. CONSTRUCTION PROBABLY WILL NOT BEGIN UNTIL NEAR THE END OF 1978. COMMERCIAL START-UP DATE HAS BEEN DELAYED ONE YEAR TO JANUARY 1981. THE A-E DESIGN FIRM IS SARGENT AND LUNDY.
COLORADO UTE ELECTRIC ASSN. CRAIG 1 450 MW - NEW COAL 0.45 PERCENT SULFUR PEABODY ENGINEERING LIMESTONE STARTUP 3/79	THE CONSTRUCTION OF THE LIMESTONE SLURRY SPRAY TOWER SCRUBBING SYSTEM FOR SULFUR DIOXIDE REMOVAL FROM LOW-SULFUR COAL-FIRED BOILER FLUE GAS IS NOW 30% COMPLETE. THE FOUNDATION IS COMPLETE AND THE SILOS ARE UP. PARTICULATE CONTROL WILL BE PROVIDED BY HOT-SIDE ESP'S UPSTREAM OF THE SCRUBBER PLANT. SLUDGE DISPOSAL IS UNDECIDED. THERE WILL BE A STEAM COIL TYPE STACK GAS REHEAT INCLUDED. REQUIRED PARTICULATE AND SULFUR DIOXIDE REMOVAL EFFICIENCIES ARE 99.8 AND 85 PERCENT, RESPECTIVELY. FGD SYSTEM START-UP IS SCHEDULED FOR SPRING 1979.
COLORADO UTE ELECTRIC ASSN. CRAIG 2 450 MW - NEW COAL 0.45 PERCENT SULFUR PEABODY ENGINEERING LIMESTONE STARTUP 3/79	PEABODY ENGINEERED SYSTEMS HAS BEEN AWARDED A CONTRACT TO DESIGN AND SUPPLY A LIMESTONE SLURRY SPRAY TOWER SCRUBBING SYSTEM FOR SO2 REMOVAL FROM LOW-SULFUR COAL-FIRED BOILER FLUE GAS FOR UNITS 1 AND 2. PARTICULATE CONTROL WILL BE PROVIDED BY HOT-SIDE ESP'S UPSTREAM OF THE SCRUBBER PLANT. SLUDGE WILL BE STABILIZED AND HAULED TO A MINEFILL. THERE WILL BE A STEAM COIL TYPE STACK GAS REHEATER INCLUDED. REQUIRED PARTICULATE AND SO2 REMOVAL EFFICIENCIES ARE 99.8 AND 85 PERCENT, RESPECTIVELY. FGD CONSTRUCTION IS NOW 30% COMPLETE.
COLUMBUS & SOUTHERN OHIO ELEC. CONESVILLE 5 400 MW - NEW COAL 4.5 - 4.9 PERCENT SULFUR AIR CORRECTION DIVISION, UOP LIME STARTUP 1/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE BOILER AND ESP WERE COMPLETED AND PLACED IN SERVICE IN SEPT. 1976. THE B-SIDE MODULE BECAME AVAILABLE FOR SERVICE IN JANUARY 1977. COMMERCIAL OPERATIONS WERE ACHIEVED ON FEBRUARY 13, 1977. THE EMISSION CONTROL SYSTEM FOR THIS UNIT CONSISTS OF A COLD-SIDE ESP FOLLOWED BY TWO TCA LIME SCRUBBING MODULES SUPPLIED BY UOP. DRAVO IS SUPPLYING THE THIOSORBIC LIME SCRUBBING REAGENT. IUCS IS SUPPLYING THEIR POZ-O-TEC SLUDGE STABILIZATION FACILITY.
COLUMBUS & SOUTHERN OHIO ELEC. CONESVILLE 6 430 MW - NEW COAL 4.5 - 4.9 PERCENT SULFUR AIR CORRECTION DIVISION, UOP LIME STARTUP 4/78	THE UTILITY SIGNED LONG-TERM CONTRACTS WITH DRAVO FOR THE PURCHASE OF THIOSORBIC LIME AND WITH IUCS FOR A SLUDGE FIXATION SYSTEM. CONSTRUCTION OF THIS UNIT COMMENCED IN 1977 AND WAS COMPLETED IN JANUARY 1978. SIMILAR TO CONESVILLE NO.5, THIS MINE MOUTH PLANT BURNS COAL WITH 17 PERCENT ASH CONTENT AND 4.5 TO 4.9 PERCENT SULFUR CONTENT. THERE IS AN ELECTROSTATIC PRECIPITATOR UPSTREAM OF THE FGD SYSTEM. THE FGD SYSTEM INCLUDES TWO TCA MODULES FOR THE REMOVAL OF SO2. THE A-E DESIGN FIRM IS BLACK AND VEATCH. THE UNIT BECAME OPERATIONAL IN JUNE 1978.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
COLUMBUS & SOUTHERN OHIO ELEC. POSTON 5 375 MW - NEW COAL 2.5 PERCENT SULFUR VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 0/83	THIS UNIT WILL BURN HIGH SULFUR OHIO COAL (APPROXIMATELY 2.5 PERCENT SULFUR CONTENT). THE DESIGN OF THE EMISSION CONTROL STRATEGY HAS NOT YET BEEN FINALIZED. THE PROCESS WILL EITHER BE LIME, LIMESTONE, OR DOUBLE ALKALI.
COLUMBUS & SOUTHERN OHIO ELEC. POSTON 6 375 MW - NEW COAL 2.5 PERCENT SULFUR VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 0/85	THIS UNIT WILL BURN HIGH SULFUR COAL (APPROXIMATELY 2.5 PERCENT SULFUR CONTENT). THE DESIGN OF THE EMISSION CONTROL STRATEGY FOR THIS UNIT HAS NOT YET BEEN FINALIZED.
COMMONWEALTH EDISON POWERTON 51 425 MW - RETROFIT COAL 3.6 PERCENT SULFUR AIR CORRECTION DIVISON, UOP LIMESTONE STARTUP 3/79	THE AIR CORRECTION DIVISION OF UOP HAS AWARDED THE CONTRACT FOR A WET LIMESTONE SYSTEM THAT WILL BE BACKFITTED ONTO BOILER NO. 51, ONE OF TWO IDENTICAL BOILERS SUPPLYING STEAM TO AN 850-MW TURBINE-GENERATOR. THE FGD SYSTEM IS DESIGNED TO TREAT FLUE GAS WHICH COMES FROM THE COMBUSTION OF HIGH SULFUR COAL (3.6 PERCENT SULFUR; 8.3 PERCENT ASH; 17.3 PERCENT MOISTURE; 10,500 BTU/LB.) AND MEET SO2 EMISSION STANDARDS OF 1.8 LB. SO2/MM BTU. CURRENTLY, EXCAVATION, BACKFILL, AND STRUCTURAL STEEL ERECTION IS IN PROGRESS.
COOPERATIVE POWER ASSOCIATION COAL CREEK 1 545 MW - NEW LIGNITE - 0.63 PERCENT SULFUR COMBUSTION ENGINEERING LIME STARTUP 2/79	THIS UNIT IS UNDER THE COMBINED OWNERSHIP OF COOP POWER AND UNITED POWER. THE CONTRACT FOR THIS SCRUBBING SYSTEM HAS BEEN AWARDED TO COMBUSTION ENGINEERING FOR THE INSTALLATION OF LIME FGD SYSTEMS ON UNITS 1 AND 2 NOS. 1 & 2 AT THIS STATION. THE SCRUBBING SYSTEM FOR EACH BOILER WILL CONSIST OF FOUR SPRAY TOWER ABSORBER MODULES FOR SO2 REMOVAL. ELECTROSTATIC PRECIPITATORS WILL BE INSTALLED UPSTREAM OF EACH SCRUBBING SYSTEM. CONSTRUCTION BEGAN EARLY IN AUGUST 1977 AND THE UNIT IS NOW 70-75% COMPLETE. BAD WINTER WEATHER SLOWED CONSTRUCTION SLIGHTLY.
COOPERATIVE POWER ASSOCIATION COAL CREEK 2 545 MW - NEW LIGNITE - 0.63 PERCENT SULFUR COMBUSTION ENGINEERING LIME STARTUP 11/79	THIS UNIT IS UNDER THE COMBINED OWNERSHIP OF COOP POWER AND UNITED POWER THE CONTRACT FOR THIS SCRUBBING SYSTEM HAS BEEN AWARDED TO COMBUSTION ENGINEERING FOR THE INSTALLATION OF LIME FGD SYSTEMS ON UNITS 1 AND 2 NOS. 1 & 2 AT THIS STATION. THE SCRUBBING SYSTEM FOR EACH BOILER WILL CONSIST OF FOUR SPRAY TOWER ABSORBER MODULES FOR SO2 REMOVAL. ELECTROSTATIC PRECIPITATORS WILL BE INSTALLED UPSTREAM OF EACH SCRUBBING SYSTEM. CONSTRUCTION BEGAN IN AUGUST 1977 AND IS NOW 40% COMPLETE. THERE HAVE BEEN MINOR DELAYS BUT START-UP IS STILL SCHEDULED FOR 11/79.
DELMARVA POWER & LIGHT DELWARE CITY 1, 2 & 3 180 MW - RETROFIT COKE 7-8 PERCENT SULFUR DAVY POWERGAS WELLMAN LORD STARTUP 6/80	DELMARVA'S DELAWARE CITY PLANT HAS 4 BOILERS, 3 OF WHICH EACH HAVE STEAM CAPACITIES OF 500K LBS/HR. THE BOILERS GENERATE STEAM AS WELL AS ELECTRICAL POWER FOR GETTY REFINING & MARKETING. 7-8 % S COKE WILL BE BURNED IN THE BOILERS (INSTEAD OF THE LOW-S CRUDE OIL NOW BURNED) WHEN THE CONTROL SYSTEM GOES INTO OPERATION IN APRIL 1980. DELMARVA WILL USE VENTURI SCRUBBERS FOR PARTICULATE REMOVAL AND WELLMAN LORD FGD SYSTEMS AT EACH BOILER GAS EXIT FOR SO2 CONTROL. PARTICULATE AND SULFUR DIOXIDE REMOVAL EFFICIENCIES ARE 90 AND 85-90 PERCENT RESPECTIVELY. CONSTRUCTION IS 6% COMPLETE.
DUQUESNE LIGHT ELRAMA POWER STATION 510 MW - RETROFIT COAL 1.8-2.2 PERCENT SULFUR CHEMICO LIME STARTUP 10/75	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. OPERATIONS ARE CONTINUING WITH THREE BOILERS COUPLED INTO THE FIVE-MODULE SCRUBBING SYSTEM. THE PLANT IS FIRING 1.8 - 2.2 PERCENT SULFUR COAL. SCRUBBING WASTES ARE CHEMICALLY FIXATED BY THE IUCS SYSTEM AND LANDFILLED. ESP'S AND MECHANICAL COLLECTORS ARE USED FOR PARTICULATE CONTROL.
DUQUESNE LIGHT PHILLIPS POWER STATION 410 MW - RETROFIT COAL 1.8-2.2 PERCENT SULFUR CHEMICO LIME STARTUP 7/73	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS SCRUBBING SYSTEM HAS BEEN IN SERVICE SINCE JULY 1973. ALL 6 BOILERS ARE COUPLED INTO THE SCRUBBING SYSTEM. THE PLANT FIRES COAL WITH A HEATING VALUE OF 11,000 BTU/LB AND ASH AND SULFUR CONTENTS OF 21 PERCENT AND 1.8 - 2.2 PERCENT, RESPECTIVELY. DEWATERED SLUDGE FROM THE IUCS INTERIM PROCESSING PLANT IS BEING HAULED TO AN OFF-SITE LANDFILL. THE SLUDGE CONTAINS NO FIXATIVE.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
EASTERN KENTUCKY POWER COOP SPURLOCK 2 500 MW - NEW COAL COMBUSTION ENGINEERING LIME STARTUP 3/80	THE SPURLOCK GENERATING PLANT IS LOCATED APPROXIMATELY 3 MILES WEST OF MAYSVILLE, KENTUCKY. TWO NEW UNITS ARE SCHEDULED FOR THIS STATION. UNIT NO. 1 BEGAN OPERATION IN EARLY SEPT. UNIT 2 WILL BE CONTROLLED BY A 99.5 PERCENT EFFICIENT ESP. THE UTILITY HAS COMPLETED SPECIFICATIONS FOR THE SCRUBBING SYSTEM. MAKEUP WATER WILL COME FROM COOLING TOWER BLOWDOWN. A CONTRACT HAS BEEN AWARDED TO COMBUSTION ENGINEERENG TO SUPPLY A LIME SYSTEM.
GENERAL PUBLIC UTILITIES COHO 1 800 MW - NEW COAL 3.5 PERCENT SULFUR VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 5/87	STARTUP DATE CHANGED TO 5/87 FOR BOTH BOILER AND DESULFURIZATION SYSTEM. LIME AND LIMESTONE SCRUBBING ARE THE PRIMARY STRATEGIES BEING CONSIDERED FOR COMPLIANCE WITH NEW SOURCE PERFORMANCE STANDARDS. NO DECISION HAS BEEN MADE YET.
GENERAL PUBLIC UTILITIES SEWARD 7 800 MW - NEW COAL VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 5/84	STARTUP DATE CHANGED TO 5/84 FOR BOTH BOILER AND DESULFURIZATION SYSTEM. LIME AND LIMESTONE SCRUBBING ARE THE PRIMARY STRATEGIES BEING CONSIDERED FOR COMPLIANCE WITH NEW SOURCE PERFORMANCE STANDARDS. NO DECISION HAS BEEN MADE YET.
GULF POWER CRIST 4 & 5 150 MW - RETROFIT VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 0/ 0	EACH UNIT IS 75 MW. THE UTILITY IS STILL WAITING FOR A DECISION AN THE EMISSION REGULATIONS THAT THEY WILL HAVE TO MEET.
GULF POWER CRIST 6 & 7 820 MW - NEW VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 0/80	UNIT 6 IS 320 MW. UNIT 7 IS 500 MW. FGD MAY BE REQUIRED IN 1980. NO DECISION HAS YET BEEN ANNOUNCED.
GULF POWER LANSING SMITH 1 & 2 305 MW - RETROFIT COAL VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 0/80	UNIT NO. 1 IS 125 MW. UNIT NO. 2 IS 180 MW. THE UTILITY IS STILL WAITING FOR A DECISION ON THE EMISSION REGULATIONS THAT THEY WILL HAVE TO MEET.
GULF POWER SCHOLZ NOS. 1B & 2B 20 MW - RETROFIT COAL 5.0 PERCENT SULFUR (MAX) CHIYODA INTERNATIONAL LIMESTONE STARTUP 6/78	CHIYODA INTERNATIONAL WILL BE SUPPLYING A 20 MW PROTOTYPE UNIT TO BEGIN OPERATION AT THIS PLANT IN AUGUST 1978. THE CT-121 SYSTEM WILL INCLUDE A NEWLY DEVELOPED JET BUBBLING REACTOR WHICH FEATURES A LARGE GAS-LIQUID INTERFACIAL AREA AND PROVIDES PARTICULATE AS WELL AS SO2 REMOVAL. MIST ELIMINATION WILL BE PROVIDED BY A DOUBLE PASS VERTICAL CHEVRON. GYPSUM WILL BE PRODUCED AND STACKED IN THE EXISTING POND. THE STACKING CAPABILITIES OF THE GYPSUM WILL BE TESTED ALONG WITH THE GROUND WATER NEAR THE STACK SITE. NO REHEAT WILL BE INCLUDED.
HOOSIER ENERGY MEROM 1 490 MW - NEW COAL 3.5 PERCENT SULFUR MITSUBISHI INTERNATIONAL LIMESTONE STARTUP 12/80	HOOSIER COOP HAS AWARDED A CONTRACT TO MITSUBISHI INTERNATIONAL CORP. FOR TWO LIMESTONE FGD SYSTEMS FOR MEROM 1 AND 2. THE NEW 490 MW COAL-FIRED UNITS ARE PLANNED FOR LOCATION IN SULLIVAN, INDIANA. THE FLUE GAS STREAMS WILL BE CLEANED OF PARTICULATES WITH ESP'S (99.4%) AND OF SULFUR DIOXID WITH GRID-TOWER ABSORBERS (90%). SLUDGE WILL BE STABILIZED AND STOCK PILED. THE GROUND WAS BROKEN FOR CONSTRUCTION IN NOVEMBER 1977, BUT DUE TO THE BAD WINTER WEATHER, CONSTRUCTION IS ONLY 5 PERCENT COMPLETE.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
HOOSIER ENERGY MEROM 2 490 MW - NEW COAL 3.5 PERCENT SULFUR MITSUBISHI LIMESTONE STARTUP 10/81	HOOSIER COOP HAS AWARDED A CONTRACT TO MITSUBISHI INTERNATIONAL CORP. FOR TWO LIMESTONE FGD SYSTEMS FOR MEROM 1 AND 2. THE NEW 490 MW COAL-FIRED UNITS ARE PLANNED FOR LOCATION IN SULLIVAN, INDIANA. THE FLUE GAS STREAMS WILL BE CLEANED OF PARTICULATES WITH ESP'S (99.4%) AND OF SULFUR DIOXIDE WITH GRID-TOWER ABSORBERS (90%). SLUDGE WILL BE STABILIZED AND STOCK PILED. THE GROUND WAS BROKEN FOR CONSTRUCTION IN NOVEMBER 1977, BUT DUE TO THE BAD WINTER WEATHER, CONSTRUCTION IS ONLY 5 PERCENT COMPLETE.
INDIANAPOLIS POWER & LIGHT PETERSBURG 3 530 MW - NEW COAL 3.0-3.5 PERCENT SULFUR UNIVERSAL OIL PRODUCTS LIMESTONE STARTUP 10/77	THE AIR CORRECTION DIVISION OF UOP SUPPLIED THE WET LIMESTONE SCRUBBING SYSTEM AT THIS UNIT. THE UNIT BECAME OPERATIONAL ON DEC. 16,1977. AN ESP PROVIDES PRIMARY PARTICULATE CONTROL. THE UNIT FIRES BITUMINOUS COAL WITH A SULFUR CONTENT OF 3.0-3.5%, AN ASH CONTENT OF 9-10%, AND A HEAT CONTENT OF 11,000 BTU/LB. AFTER BEING DOWN FOR PROBLEMS WITH THE FLY ASH SYSTEM, THE UNIT CAME BACK ON LINE IN MID-APRIL. THE UNIT WENT BACK DOWN ON JUNE 16 WHEN THE MAIN POWER TRANSFORMER FAULTED.
INDIANAPOLIS POWER & LIGHT PETERSBURG 4 530 MW - NEW COAL 3.5 PERCENT SULFUR RESEARCH COTTRELL LIMESTONE STARTUP 4/82	INDIANAPOLIS POWER & LIGHT AWARDED A CONTRACT TO RESEARCH COTTRELL FOR A LIMESTONE SCRUBBING SYSTEM. SO2 REMOVAL EFFICIENCY WILL BE APPROXIMATELY 80 PERCENT. THIS NEW UNIT WILL FIRE HIGH-SULFUR SUBBITUMINOUS COAL WITH A HEATING VALUE OF 11,000 BTU/LB AND ASH AND SULFUR CONTENTS OF 10 PERCENT AND 3.5 PERCENT, RESPECTIVELY. A CONTRACT HAS BEEN AWARDED TO RESEARCH COTTRELL FOR A LIMESTONE FGD SYSTEM. SLUDGE WILL BE DEWATERED AND MIXED WITH FLYASH TO PRODUCE A DRY STABILIZED PRODUCT. PLANT CONSTRUCTION BEGAN IN DECEMBER 1977.
KANSAS CITY POWER & LIGHT HAWTHORN 3 140 MW - RETROFIT COAL 0.5-3.5 PERCENT SULFUR COMBUSTION ENGINEERING LIME STARTUP 11/72	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE SCRUBBER PLANT HAS BEEN CONVERTED FROM A LIMESTONE FURNACE INJECTION AND TAIL-END SYSTEM TO A TAIL-END WET LIME SYSTEM. LIME-BASED SCRUBBING COMMENCED ON FEBRUARY 7, 1977. COMPLIANCE TESTING FOR KANSAS CITY PARTICULATE STANDARDS INDICATED THE NO.3 UNIT WAS WELL WITHIN THE 0.17 POUND REGULATION. THE 2-MODULE SCRUBBER PLANT CAN ONLY BE BY-PASSED DURING EMERGENCIES.
KANSAS CITY POWER & LIGHT HAWTHORN 4 100 MW - RETROFIT COAL 0.5-3.5 PERCENT SULFUR COMBUSTION ENGINEERING LIME STARTUP 8/72	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE SCRUBBER PLANT HAS BEEN CONVERTED FROM A LIMESTONE FURNACE INJECTION AND TAIL-END SYSTEM TO A TAIL-END WET LIME SYSTEM. OPERATION IN THE LIME SCRUBBING MODE COMMENCED ON JANUARY 1, 1977. COMPLIANCE TESTING FOR KANSAS CITY PARTICULATE REGULATIONS INDICATED THE UNIT IS MEETING THE 0.17 POUND REGULATION. THE 2-MODULE SCRUBBER PLANT CAN ONLY BE BY-PASSED DURING EMERGENCIES.
KANSAS CITY POWER & LIGHT LA CYGNE 1 820 MW - NEW COAL 5.0 PERCENT SULFUR BABCOCK & WILCOX LIMESTONE STARTUP 2/73	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE EMISSION CONTROL SYSTEM FOR THIS NEW COAL-FIRED POWER-GENERATING UNIT CONSISTS OF EIGHT SCRUBBER MODULES FOR FLY ASH AND SO2 REMOVAL. EACH MODULE INCLUDES A VENTURI SCRUBBER IN SERIES WITH A 2-STAGE IMPINGEMENT PLATE ABSORBER. THE SCRUBBER PLANT IS AN INTEGRAL PART OF THE POWER-GENERATING COMPLEX, ALLOWING NO FLUE GAS BYPASS. INITIAL OPERATIONS COMMENCED IN FEB. 1973. COMMERCIAL SERVICE WAS ATTAINED BY JUNE 1973.
KANSAS POWER & LIGHT JEFFEREY 1 680 MW - NEW COAL 0.30 PERCENT SULFUR COMBUSTION ENGINEERING LIMESTONE STARTUP 6/78	KP&L HAS PURCHASED A COMBUSTION ENGINEERING AIR QUALITY CONTROL SYSTEM FOR PARTICULATE AND SO2 REMOVAL CONSISTING OF A COLD-SIDE ESP, I.D. FANS, BY-PASS CAPABILITY, AND SPRAY TOWERS. AN OVERFIRE AIR SYSTEM AT THE TANGENTIAL FIRED PULVERIZED BURNERS WILL CONTROL NOX EMISSIONS. THE CLEANED GASES WILL BE VENTED TO A 600 FT STACK. THE BOILER IS NOW OPERATIONAL AND CONSTRUCTION ON THE FGD SYSTEM IS 99% COMPLETE. THE SCRUBBER SHOULD BE ON LINE BY MID-JULY. SLUDGE DISPOSAL STRATEGY HAS NOT BEEN FINALIZED. THIS UNIT WILL FIRE 0.3% SULFUR (6% ASH) WYOMING COAL.
KANSAS POWER & LIGHT JEFFEREY 2 680 MW - NEW COAL 0.30 PERCENT SULFUR COMBUSTION ENGINEERING LIMESTONE STARTUP 6/80	KP&L HAS PURCHASED A COMBUSTION ENGINEERING AIR QUALITY CONTROL SYSTEM FOR PARTICULATE AND SO2 REMOVAL CONSISTING OF A COLD-SIDE ESP, I.D. FANS, BY-PASS CAPABILITY, AND SPRAY TOWERS. AN OVERFIRE AIR SYSTEM AT THE TANGENTIAL FIRED PULVERIZED BURNERS WILL CONTROL NOX EMISSIONS. THE CLEANED GASES WILL BE VENTED TO A 600 FT STACK. CONSTRUCTION IS PROCEEDING ACCORDING TO SCHEDULE. THE ESP'S ARE BEING INSTALLED. THE SLURRY HOLD TANKS AND ABSORBERS ARE IN PLACE. SLUDGE DISPOSAL STRATEGY HAS NOT BEEN FINALIZED. THIS UNIT WILL FIRE 0.3% SULFUR (6% ASH) WYOMING COAL.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
KANSAS POWER & LIGHT LAWRENCE 4 125 MW - RETROFIT COAL 0.5 PERCENT SULFUR COMBUSTION ENGINEERING LIMESTONE STARTUP 12/68	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE NEW LIMESTONE FGD SYSTEM COMMENCED OPERATIONS IN EARLY JANUARY 1977. THE NEW SYSTEM REPLACED MARBLE-BED TOWERS WITH SPRAY TOWERS. THERE HAVE BEEN NO FORCED SCRUBBER OUTAGES REPORTED SINCE START-UP. CONTINUOUS SO2 MONITORS HAVE RECORDED SO2 REMOVAL EFFICIANCIES OF BETTER THAN 85%. PARTICULATE REMOVAL IS REPORTED TO BE EXCELLENT, YIELDING NO VISIBLE PLUME. THE PLANT IS FIRING COAL RATED AT 10,000 BTU/LB WITH A SULFUR CONTENT OF 0.5%.
KANSAS POWER & LIGHT LAWRENCE 5 400 MW - NEW COAL 0.5 PERCENT SULFUR COMBUSTION ENGINEERING LIMESTONE STARTUP 11/71	RFFFR TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE ORIGINAL LIMESTONE INJECTION AND TAIL-END SCRUBBING SYSTEM WAS SHUT DOWN ON MARCH 20 SO THAT THE NEW ROD-SCRUBBER AND SPRAY TOWER ABSORBER SYSTEM COULD BE TIED INTO THE UNIT. THE NEW SYSTEM, WHICH INCLUDES TWO MODULES, EACH CAPABLE OF HANDLING APPROXIMATELY 50 PERCENT OF THE TOTAL BOILER FLUE GAS FLOW, CAME ON LINE ON APRIL 14, 1978. THE SYSTEM DESIGNER AND SUPPLIER IS COMBUSTION ENGINEERING. THE UNIT FIRES LOW SULFUR WYOMING COAL WITH A HEAT CONTENT OF 10,000 BTU/LB.
KENTUCKY UTILITIES GREEN RIVER 1,2 & 3 64 MW - RETROFIT COAL 3.8 PERCENT SULFUR AMERICAN AIR FILTER LIME STARTUP 9/75	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE SCRUBBER PLANT INSTALLED AT THIS STATION CONSISTS OF ONE MODULE DESIGNED TO REMOVE PARTICULATE (VARIABLE-THROAT VENTURI) AND SO2 (MOBILE-BED CONTACTOR) FROM COAL-FIRED BOILER FLUE GAS. THE SCRUBBER WAS DESIGNED AND SUPPLIED BY AAF. SLUDGE IS DISPOSED IN AN ON-SITE UNLINED POND. THE COAL BURNED HAS SULFUR AND ASH CONTENTS OF 3.8 AND 14 PERCENT RESPECTIVELY. INITIAL STARTUP OCCURRED IN SEPTEMBER 1975. COMMERCIAL OPERATION COMMENCED IN JANUARY 1976.
LAKELAND UTILITIES MCINTOSH 3 350 MW - NEW COAL 2.6 PERCENT SULFUR BABCOCK & WILCOX LIMESTONE STARTUP 10/81	THE CITY OF LAKELAND DEPARTMENT OF ELECTRIC AND WATER UTILITIES AWARDED A CONTRACT TO B&W FOR AN EMISSION CONTROL SYSTEM ON THE UTILITY'S NEW 350-MW POWER GENERATING UNIT, MCINTOSH 3. THE UNIT WILL UTILIZE COLD SIDE ESP'S FOR PARTICULATE REMOVAL AND A LIMESTONE FGD SYSTEM. START-UP IS SCHEDULED FOR OCTOBER 1981. A COAL SOURCE HAS NOT BEEN FINALIZED. CONSTRUCTION SHOULD BEGIN IN SEPTEMBER 1978.
LOUISVILLE GAS & ELECTRIC CANE RUN 4 178 MW - RETROFIT COAL 3.5 - 4.0 PERCENT SULFUR AMERICAN AIR FILTER LIME STARTUP 8/76	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE FGD SYSTEM RETROFITTED ON THIS BOILER WAS DESIGNED AND SUPPLIED BY AMERICAN AIR FILTER AND WAS FIRST PLACED IN THE GAS PATH ON AUGUST 7, 1976. THE SYSTEM CONSISTS OF TWO PARALLEL MODULES WHICH INCLUDE MOBILE BED CONTACTORS AND OPERATE WITH A CARBIDE LIME ADDITIVE. FOLLOWING A NUMBER OF MAJOR SYSTEM MODIFICATIONS (CHEVRON-TYPE MIST ELIMINATOR, OIL FIRED REHEAT, PLASITE DUCT LINER, HIGHER L/G), THE SYSTEM SUCCESSFULLY PASSED COMPLIANCE TESTING (85% SO2 REMOVAL) ON AUGUST 3 AND 4, 1977.
LOUISVILLE GAS & ELECTRIC CANE RUN 5 183 MW - RETROFIT COAL 3.5 - 4.0 PERCENT SULFUR COMBUSTION ENGINEERING LIME STARTUP 12/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE FGD SYSTEM FOR THIS UNIT WAS DESIGNED AND SUPPLIED BY COMBUSTION ENGINEERING. IT CONSISTS OF TWO SPRAY TOWER ABSORBERS FOR FULL-LOAD SO2 REMOVAL AND UTILIZES CARBIDE LIME AS THE SCRUBBING REAGENT. IN-LINE STEAM REHEAT, A COMMON REACTION TANK, AND A THICKENER FOR SOLIDS DEWATERING ARE INCLUDED. AN EXISTING UPSTREAM ESP PROVIDES PRIMARY PARTICULATE CONTROL. THE FGD SYSTEM BEGAN INITIAL OPERATION IN DEC. '77 BUT THE COAL STRIKE FORCED A PLANT SHUTDOWN. THE SYSTEM WAS RE-STARTED MARCH 24, 1978.
LOUISVILLE GAS & ELECTRIC CANE RUN 6 277 MW - RETROFIT COAL 3.5 - 4.0 PERCENT SULFUR ADL/COMBUSTION EQUIP ASSOCIATE DOUBLE ALKALI STARTUP 12/78	THE CONTRACT FOR THIS FULL-SCALE DEMONSTRATION FGD SYSTEM HAS BEEN AWARDED TO A.D.LITTLE/COMBUSTION EQUIPMENT ASSOC. FOR THE INSTALLATION OF A DOUBLE ALKALI SYSTEM. THE FEDERAL EPA WILL SUBSIDIZE A MAXIMUM $4.5 MM FOR OPERATION, RESEARCH AND DEVELOPMENT, AND REPORT WRITING FOR A ONE-YEAR PERIOD FOLLOWING THE FIRST THREE MONTHS OF OPERATION (NOTE:THIS SUBSIDY WILL NOT BE APPLIED FOR ANY CAPITAL EXPENDITURES). ENGINEERING DESIGN WORK IS UNDERWAY. SITE PREPARATION, EXCAVATION AND FOUNDATION WORK COMMENCED IN JULY. DUCTWORK TIE-IN IS COMPLETE.
LOUISVILLE GAS & ELECTRIC MILL CREEK 1 330 MW - RETROFIT COAL 3.5- 4.0 PERCENT SULFUR VENDOR NOT SELECTED LIME STARTUP 1/82	A COMPLIANCE SCHEDULE HAS BEEN SUBMITTED TO THE JEFFERSON COUNTY AIR POLLUTION CONTROL DISTRICT WITH 1/82 ESTABLISHED AS THE STARTUP DATE FOR AN FGD SYSTEM. OPERATING DATA AND INFORMATION FROM THE FULL-SCALE SCRUBBER PLANT NOW IN SERVICE ON THE NO.4 UNIT AT CANE RUN WILL BE OBTAINED BEFORE THE UTILITY PROCEEDS WITH ADDITIONAL SYSTEM DESIGN WORK.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
LOUISVILLE GAS & ELECTRIC MILL CREEK 2 330 MW - RETROFIT COAL 3.5- 4.0 PERCENT SULFUR VENDOR NOT SELECTED LIME STARTUP 1/81	A COMPLIANCE SCHEDULE HAS BEEN SUBMITTED TO THE JEFFERSON COUNTY AIR POLLUTION CONTROL DISTRICT WITH 1/81 ESTABLISHED AS THE STARTUP DATE FOR AN FGD SYSTEM. OPERATING DATA AND INFORMATION FROM THE FULL-SCALE SCRUBBER PLANT NOW IN SERVICE ON THE NO.4 UNIT AT CANE RUN WILL BE OBTAINED BEFORE THE UTILITY PROCEEDS WITH ADDITIONAL SYSTEM DESIGN WORK.
LOUISVILLE GAS & ELECTRIC MILL CREEK 3 425 MW - NEW COAL 3.5- 4.0 PERCENT SULFUR AMERICAN AIR FILTER LIME STARTUP 7/78	BECAUSE POWER DEMAND HAS NOT COME UP AS RAPIDLY AS HAD BEEN EXPECTED, UNIT START-UP HAS BEEN MOVED BACK TO LATE JULY 1978. CONSTRUCTION ON THIS NEW FACILITY'S FGD SYSTEM IS NEARING COMPLETION. THE SYSTEM IS DESIGNED AND SUPPLIED BY AMERICAN AIR FILTER AND WILL UTILIZE CARBIDE LIME AS THE ABSORBENT. FOUR MOBILE-BED ABSORBERS WILL TREAT THE FLUE GAS RESULTING FROM THE COMBUSTION OF HIGH SULFUR COAL. THE SYSTEM WILL OPERATE IN A CLOSED WATER LOOP. THE SCRUBBING WASTE WILL BE STABILIZED WITH FLYASH AND LIME.
LOUISVILLE GAS & ELECTRIC MILL CREEK 4 495 MW - NEW COAL 3.5- 4.0 PERCENT SULFUR AMERICAN AIR FILTER LIME STARTUP 6/80	BECAUSE POWER DEMAND HAS NOT COME UP AS RAPIDLY AS HAD BEEN EXPECTED, UNIT START-UP HAS BEEN MOVED BACK TO JUNE 1980. CONSTRUCTION OF THIS NEW 495-MW COAL-FIRED UNIT IS ON SCHEDULE. CURRENTLY, FOUNDATION WORK IS IN PROGRESS. THIS AAF SYSTEM WILL INCLUDE MOBILE-BED ABSORBERS TREATING HIGH SULFUR COAL FLUE GAS. THE SYSTEMS WATER LOOP WILL BE CLOSED. THE SLUDGE WILL BE STABILIZED WITH LIME AND FLYASH. STEAM REHEAT WILL PROVIDE GAS TEMPERATURE ELEVATION OF THE SCRUBBED GASES PRIOR TO DISCHARGE TO THE MAIN STACK.
LOUISVILLE GAS & ELECTRIC PADD'S RUN 6 65 MW - RETROFIT COAL 3.5 - 4.0 PERCENT SULFUR COMBUSTION ENGINEERING LIME STARTUP 4/73	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS SCRUBBING SYSTEM WAS DESIGNED BY COMBUSTION ENGINEERING AND PLACED IN SERVICE IN APRIL 1973. THE FGD SYSTEM CONSISTS OF TWO 2-STAGE MARBLE BED ABSORBERS WHICH ARE DESIGNED TO USE CARBIDE LIME ADDITIVE AS THE SCRUBBING REAGENT. PADDYS RUN NO. 6 IS A PEAK-LOAD UNIT THAT OPERATES ONLY DURING DEMAND PERIODS. AN EXTENSIVE EPA SCRUBBER/SLUDGE EVALUATION STUDY WAS COMPLETED IN AUGUST 1977. THIS UNIT WILL BE RETIRED WHEN MILL CREEK 3 COMES ON LINE.
MINNESOTA POWER & LIGHT CLAY BOSWELL 4 500 MW - NEW COAL 0.8 PERCENT SULFUR PEABODY ENGINEERING LIME/ALKALINE FLYASH STARTUP 5/80	MINNESOTA P & L HAS AWARDED A CONTRACT TO PEABODY ENGINEERING FOR A LIME/ALKALINE FLYASH SCRUBBING SYSTEM. THE CONFIGURATION WILL BE VENTURI SCRUBBERS FOLLOWED BY SPRAY TOWERS. HOT SIDE ESP'S WILL BE USED FOR PARTICULATE CONTROL. STACK GAS REHEAT WILL BE ACCOMPLISHED BY BYPASSING 5% OF FLUE GAS AROUND THE SCRUBBER. THE UNIT WILL FIRE SUB-BITUMINOUS COLSTRIP COAL WITH A SULFUR CONTENT OF 0.8%, AND AN ASH CONTENT OF 9.0% (HEATING VALUE - 8300 BTU/LB). MAKE-UP WATER SOURCE WILL BE THE RIVER AND THE CLAY-LINED POND. CONSTRUCTION OF STRUCTURAL STEEL BEGAN APRIL 7, 1978.
MINNKOTA POWER COOPERATIVE MILTON R. YOUNG 2 450 MW - NEW LIGNITE 0.7 PERCENT SULFUR ADL/COMBUSTION EQUIP ASSOCIATE LIME/ALKALINE FLYASH STARTUP 9/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS LIME/ALKALINE FLYASH SCRUBBING SYSTEM WAS DESIGNED AND SUPPLIED BY ADL/COMBUSTION EQUIPMENT ASSOCIATES. IT CONSISTS OF A COLD-SIDE ESP FOLLOWED BY TWO SPRAY TOWERS. MIST ELIMINATION IS PROVIDED BY A WASH TRAY AND CHEVRON MIST ELIMINATOR. 15% FLUE GAS BYPASS PROVIDES STACK GAS REHEAT. THE UNIT FIRES A LOW-SULFUR NORTH DAKOTA LIGNITE WITH AN AVERAGE ASH CONTENT OF 8 PERCENT, SULFUR CONTENT OF 0.7 PERCENT, AND HEAT CONTENT OF 6500 BTU/LB. THE FLY ASH ALKALINITY IS USED AS THE PRIMARY SO2 REAGENT.
MONTANA POWER COLSTRIP 1 360 MW - NEW COAL 0.8 PERCENT SULFUR ADL/COMBUSTION EQUIP ASSOCIATE LIME/ALKALINE FLYASH STARTUP 11/75	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS FGD EQUIPPED UNIT WAS DECLARED COMMERCIAL IN NOVEMBER 1975. THE SCRUBBING SYSTEM PROVIDES PARTICULATE AND SO2 CONTROL WITH THREE SCRUBBER MODULES. EACH MODULE CONSISTS OF A DOWNFLOW VENTURI SCRUBBER CENTERED WITHIN AN UPFLOW SPRAY TOWER ABSORBER. EACH MODULE CAN TREAT 40% OF THE TOTAL BOILER FLUE GAS AND THE MODULES CANNOT BE BYPASSED. THE UNSTABILIZED SLUDGE IS DISPOSED IN AN ON-SITE LINED DISPOSAL POND. IN-LINE STEAM REHEAT AND CLOSED WATER LOOP CAPABILITY ARE INCLUDED IN THE SYSTEM.
MONTANA POWER COLSTRIP 2 360 MW - NEW COAL 0.8 PERCENT SULFUR ADL/COMBUSTION EQUIP ASSOCIATE LIME/ALKALINE FLYASH STARTUP 07/60	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS FGD EQUIPPED UNIT WAS DECLARED COMMERCIAL IN AUGUST 1976. THE SCRUBBING SYSTEM PROVIDES PARTICULATE AND SO2 CONTROL WITH THREE SCRUBBER MODULES. EACH MODULE CONSISTS OF A DOWNFLOW VENTURI SCRUBBER CENTERED WITHIN AN UPFLOW SPRAY TOWER ABSORBER. EACH MODULE CAN TREAT 40% OF THE TOTAL BOILER FLUE GAS AND THE MODULES CANNOT BE BYPASSED. THE UNSTABILIZED SLUDGE IS DISPOSED IN AN ON-SITE LINED DISPOSAL POND. IN-LINE STEAM REHEAT AND CLOSED WATER LOOP CAPABILITY ARE INCLUDED IN THE SYSTEM.

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SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
MONTANA POWER COLSTRIP 3 700 MW - NEW COAL 0.7 PERCENT SULFUR ADL/COMBUSTION EQUIP ASSOCIATE LIME/ALKALINE FLYASH STARTUP 7/80	A CONTRACT FOR THE INSTALLATION OF TWO ADDITIONAL LIME/ALKALINE FLYASH SCRUBBING SYSTEMS HAS BEEN AWARDED TO A.D. LITTLE/COMBUSTION EQUIPMENT ASSOCIATES. THESE SYSTEMS WILL BE INSTALLED ON UNITS NOS. 3 AND 4 OF THE COLSTRIP POWER STATION. COLSTRIP UNITS 1 AND 2 ARE BOTH EQUIPPED WITH OPERATIONAL LIME/ALKALINE FLYASH SCRUBBING SYSTEMS FOR THE REMOVAL OF PARTICULATES AND SULFUR DIOXIDE.
MONTANA POWER COLSTRIP 4 700 MW - NEW COAL 0.7 PERCENT SULFUR ADL/COMBUSTION EQUIP ASSOCIATE LIME/ALKALINE FLYASH STARTUP 7/81	A CONTRACT FOR THE INSTALLATION OF TWO ADDITIONAL LIME/ALKALINE FLYASH SCRUBBING SYSTEMS HAS BEEN AWARDED TO A.D. LITTLE/COMBUSTION EQUIPMENT ASSOCIATES. THESE SYSTEMS WILL BE INSTALLED ON UNITS NOS. 3 AND 4 OF THE COLSTRIP POWER STATION. COLSTRIP UNITS 1 AND 2 ARE BOTH EQUIPPED WITH OPERATIONAL LIME/ALKALINE FLYASH SCRUBBING SYSTEMS FOR THE REMOVAL OF PARTICULATES AND SULFUR DIOXIDE.
NEVADA POWER HARRY ALLEN 1 500 MW - NEW COAL VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 6/83	CONSIDERING HOT SIDE ESP IN CONJUNCTION WITH AN FGD SYSTEM. SPECIFICATIONS HAVE NOT YET BEEN PREPARED.
NEVADA POWER HARRY ALLEN 2 500 MW - NEW COAL VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 6/84	CONSIDERING HOT SIDE ESP IN CONJUNCTION WITH AN FGD SYSTEM. SPECIFICATIONS HAVE NOT YET BEEN PREPARED.
NEVADA POWER HARRY ALLEN 3 500 MW - NEW COAL VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 6/85	CONSIDERING HOT SIDE ESP IN CONJUNCTION WITH AN FGD SYSTEM. SPECIFICATIONS HAVE NOT YET BEEN PREPARED.
NEVADA POWER HARRY ALLEN 4 500 MW - NEW COAL VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 6/86	CONSIDERING HOT SIDE ESP IN CONJUNCTION WITH AN FGD SYSTEM. SPECIFICATIONS HAVE NOT YET BEEN PREPARED.
NEVADA POWER REID GARDNER 1 125 MW - RETROFIT COAL 0.5 - 1.0 PERCENT SULFUR ADL/COMBUSTION EQUIP ASSOCIATE SODIUM CARBONATE STARTUP 4/74	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS SODIUM CARBONATE-BASED (TRONA) SCRUBBING SYSTEM CONSISTS OF ONE MODULE CONTAINING A TWIN VARIABLE-THROAT VENTURI SCRUBBER FOLLOWED BY A SEPARATOR IN SERIES WITH A SINGLE-STAGE PERFORATED-PLATE WASH TOWER. PRIMARY PARTICULATE CONTROL IS PROVIDED BY UPSTREAM MECHANICAL COLLECTORS. AN INDIRECT STEAM HOT AIR REHEAT SYSTEM RAISES THE GAS TEMPERATURE 30 F PRIOR TO DISCHARGE TO THE MAIN STACK. THE FLUE GAS CLEANING WASTES ARE ULTIMATELY DISPOSED IN AN ON-SITE CLAY-LINED SOLAR EVAPORATION POND.
NEVADA POWER REID GARDNER 2 125 MW - RETROFIT COAL 0.5 - 1.0 PERCENT SULFUR ADL/COMBUSTION EQUIP ASSOCIATE SODIUM CARBONATE STARTUP 4/74	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS SODIUM CARBONATE-BASED (TRONA) SCRUBBING SYSTEM CONSISTS OF ONE MODULE CONTAINING A TWIN VARIABLE-THROAT VENTURI SCRUBBER FOLLOWED BY A SEPARATOR IN SERIES WITH A SINGLE-STAGE PERFORATED-PLATE WASH TOWER. PRIMARY PARTICULATE CONTROL IS PROVIDED BY UPSTREAM MECHANICAL COLLECTORS. AN INDIRECT STEAM HOT AIR REHEAT SYSTEM RAISES THE GAS TEMPERATURE 30 F PRIOR TO DISCHARGE TO THE MAIN STACK. THE FLUE GAS CLEANING WASTES ARE ULTIMATELY DISPOSED IN AN ON-SITE CLAY-LINED SOLAR EVAPORATION POND.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
NEVADA POWER REID GARDNER 3 125 MW - NEW COAL 0.5 - 1.0 PERCENT SULFUR ADL/COMBUSTION EQUIP ASSOCIATE SODIUM CARBONATE STARTUP 7/76	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS UNIT IS A NEW COAL-FIRED BOILER THAT IS EQUIPPED WITH SODIUM CARBONATE-BASED(TRONA)SCRUBBING SYSTEM WHICH INCORPORATES A TWIN VARIABLE-THROAT VENTURI SCRUBBER FOLLOWED BY A SEPARATOR IN SERIES WITH A SINGLE-STAGE PERFORATED-PLATE WASH TOWER. MECHANICAL COLLECTORS PROVIDE PRIMARY PARTICULATE CONTROL. REHEAT IS PROVIDED BY AN INDIRECT STEAM HOT AIR REHEAT SYSTEM. WASTE DISPOSAL IS ON-SITE CLAY-LINED POND. DIRECT HOT AIR REHEAT SYSTEM. WASTE DISPOSAL IS ON-SITE CLAY-LINED POND.
NEVADA POWER REID GARDNER 4 125 MW - NEW COAL 0-5- 1.0 PERCENT SULFUR ADL/COMBUSTION EQUIP ASSOCIATE SODIUM CARBONATE STARTUP 0/ 0	NEVADA POWER COMPANY HAS SIGNED A LETTER OF INTENT WITH COMBUSTION EQUIPMENT ASSOCIATES FOR THE CONSTRUCTION OF AN FGD SYSTEM ON REID GARDNER NO. 4. CONSTRUCTION OF THE BOILER, HOWEVER, HAS BEEN INDEFINITELY POSTPONED.
NEVADA POWER WARNER VALLEY 1 250 MW - NEW COAL VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 6/82	SPECIFICATIONS ARE BEING PREPARED FOR A SCRUBBING SYSTEM. NEVADA POWER HAS NOT YET ANNOUNCED PLANS FOR THIS UNIT'S EMISSION CONTROL STRATEGY.
NEVADA POWER WARNER VALLEY 2 250 MW - NEW COAL VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 6/83	SPECIFICATIONS ARE BEING PREPARED FOR A SCRUBBING SYSTEM. NEVADA POWER HAS NOT YET ANNOUNCED PLANS FOR THIS UNIT'S EMISSION CONTROL STRATEGY.
NEW ENGLAND ELEC SYSTEM BRAYTON POINT 3 650 MW - RETROFIT FUEL OIL, LOW SULFUR VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 0/ 0	THE UTILITY IS CURRENTLY INVESTIGATING VARIOUS ADVANCED REGENERABLE FLUE GAS DESULFURIZATION SYSTEMS WHICH OFFER A BREAKTHROUGH IN OPERATING COSTS AND PRODUCE ELEMENTAL SULFUR AS AN END PRODUCT. THE UTILITY IS CURRENTLY INVOLVED IN BENCH AND LABORATORY SCALE INVESTIGATIONS OF SULFUR RECOVERY. THE NO. 3 UNIT IS CURRENTLY OPERATIONAL, FIRING LOW SULFUR FUEL OIL.
NIAGARA MOHAWK POWER COOP CHARLES R. HUNTLEY 6 100 MW - RETROFIT COAL 2.5-4.5 PERCENT SULFUR ATOMICS INTERNATIONAL AQUEOUS CARBONATE STARTUP 0/80	A CONTRACT WAS AWARDED TO ATOMICS INTERNATIONAL FOR THE DESIGN AND INSTALLATION OF AN AQUEOUS CARBONATE FGD SYSTEM. THIS DEMONSTRATION SYSTEM WILL PRODUCE END-PRODUCT SULFUR. FUNDS ARE BEING PROVIDED BY THE US EPA AND THE EMPIRE STATE ELECTRIC ENERGY RESEARCH CORP. THE DESIGN SO2 REMOVAL EFFICIENCY WILL BE 90 PERCENT. GROUND BREAKING FOR CONSTRUCTION WILL BE IN LATE FALL 1978.
NORTHERN INDIANA PUB SERVICE BAILLY 7 190 MW - RETROFIT COAL 3 PERCENT SULFUR VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 0/ 0	NORTHERN INDIANA PUBLIC SERVICE IS CURRENTLY CONSIDERING A LIME OR LIMESTONE SCRUBBING UNIT FOR BAILLY 7 AND 8. THEY ARE ALSO WAITING FOR PERFORMANCE RESULTS OF THE WELLMAN LORD/ALLIED CHEMICAL UNIT IN SERVICE AT DEAN H. MITCHELL 11. LOW SULFUR COAL MAY BE EMPLOYED TO COMPLY WITH SO2 EMISSION REGULATIONS. APPLICABLE INDIANA SO2 REGULATIONS ARE STILL NOT FIRMLY ESTABLISHED.
NORTHERN INDIANA PUB SERVICE BAILLY 8 400 MW - RETROFIT COAL 3 PERCENT SULFUR VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 0/ 0	NORTHERN INDIANA PUBLIC SERVICE IS CURRENTLY CONSIDERING A LIME OR LIMESTONE SCRUBBING UNIT FOR BAILLY 7 AND 8. THEY ARE ALSO WAITING FOR PERFORMANCE RESULTS OF THE WELLMAN LORD/ALLIED CHEMICAL UNIT IN SERVICE AT DEAN H. MITCHELL 11. LOW SULFUR COAL MAY BE EMPLOYED TO COMPLY WITH SO2 EMISSION REGULATIONS. APPLICABLE INDIANA SO2 REGULATIONS ARE STILL NOT FIRMLY ESTABLISHED.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
NORTHERN INDIANA PUB SERVICE DEAN H. MITCHELL 11 115 MW - RETROFIT COAL 3.2-3.5 PERCENT SULFUR DAVY POWERGAS/ALLIED CHEMICAL WELLMAN LORD/ALLIED CHEMICAL STARTUP 11/76	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS FGD SYSTEM IS AN INTEGRATION OF THE WELLMAN-LORD SO2 RECOVERY PROCESS OFFERED BY DAVY POWERGAS AND THE SO2 TO SULFUR REDUCTION PROCESS DEVELOPED BY ALLIED CHEMICAL. DAVY POWERGAS IS THE DESIGN AND CONSTRUCTION FIRM AND ALLIED CHEMICAL IS SYSTEM OPERATOR AND PRODUCT MARKETER. PERFORMANCE TESTS WERE SUCCESSFULLY COMPLETED ON SEPTEMBER 14, 1977. A DEMONSTRATION YEAR COMMENCED ON SEPTEMBER 16, 1977.
NORTHERN STATES POWER SHERBURNE 1 710 MW - NEW COAL 0.8 PERCENT SULFUR COMBUSTION ENGINEERING LIMESTONE/ALKALINE FLYASH STARTUP 3/76	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. FULL COMMERCIAL OPERATION OF THE SYSTEM BEGAN ON MAY 1, 1976. THE SCRUBBING SYSTEM FOR THIS UNIT CONSISTS OF 12 MODULES. EACH SCRUBBING MODULE INCORPORATES A VENTURI-ROD SECTION AND A MARBLE BED ABSORBER FOR PARTICULATE AND SULFUR DIOXIDE REMOVAL. A FORCED OXIDATION SYSTEM CONVERTS ALL THE CALCIUM SULFITE TO SULFATE PRIOR TO DISCHARGE TO A CLAY-LINED SETTLING POND. STACK GAS REHEAT IS PROVIDED BY IN-LINE HOT WATER TUBES.
NORTHERN STATES POWER SHERBURNE 2 710 MW - NEW COAL 0.8 PERCENT SULFUR COMBUSTION ENGINEERING LIMESTONE/ALKALINE FLY ASH STARTUP 4/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE SHERBURNE NO. 2 AIR QUALITY CONTROL SYSTEM IS IDENTICAL IN DESIGN TO THE SYSTEM IN OPERATION ON THE NO. 1 UNIT AT THIS STATION. TWELVE 2-STAGE PARTICULATE SCRUBBER (VENTURI-ROD SCRUBBER) AND SULFUR DIOXIDE ABSORBER (MARBLE-BED ABSORBER) MODULES ARE PROVIDED FOR FLY ASH AND SO2 CONTROL. ELEVEN MODULES ARE REQUIRED FOR FULL GENERATING CAPACITY OPERATIONS. THE CALCIUM SULFITE IS FORCIBLY OXIDIZED TO SULFATE PRIOR TO DISCHARGE TO THE DISPOSAL POND. STACK GAS REHEAT PROVIDED BY IN-LINE HOT WATER TUBES.
NORTHERN STATES POWER SHERBURNE 3 860 MW - NEW COAL 0.8 PERCENT SULFUR COMBUSTION ENGINEERING LIMESTONE/ALKALINE FLY ASH STARTUP 5/81	TWO ADDITIONAL COAL-FIRED POWER-GENERATING UNITS ARE SCHEDULED TO BE INSTALLED AT NSP'S SHERBURNE COUNTY GENERATING STATION IN BECKER MINNESOTA. COMBUSTION ENGINEERING WAS AWARDED A CONTRACT FOR LIMESTONE SLURRY SPRAY TOWER FGD SYSTEMS ON THE 860 MW UNITS 3 & 4. THE 2- STAGE SCRUBBING SYSTEM WILL REMOVE PARTICULATE (99.5%) & SO2 (80%). THE BOILER CONTRACT HAS BEEN AWARDED TO BABCOCK AND WILCOX AND THE TURBINE WILL BE SUPPLIED BY GENERAL ELECTRIC. CONSTRUCTION IS SCHEDULED TO COMMENCE DURING THE SUMMER OF '78. COMMERCIAL START-UP DATES ARE NOW SCHEDULED FOR MAY 1981 AND MAY 1983.
NORTHERN STATES POWER SHERBURNE 4 860 MW - NEW COAL 0.8 PERCENT SULFUR COMBUSTION ENGINEERING LIMESTONE/ALKALINE FLY ASH STARTUP 5/83	TWO ADDITIONAL COAL-FIRED POWER-GENERATING UNITS ARE SCHEDULED TO BE INSTALLED AT NSP'S SHERBURNE COUNTY GENERATING STATION IN BECKER MINNESOTA. COMBUSTION ENGINEERING WAS AWARDED A CONTRACT FOR LIMESTONE SLURRY SPRAY TOWER FGD SYSTEMS ON THE 860 MW UNITS 3 & 4. THE 2-STAGE SCRUBBING SYSTEM WILL REMOVE PARTICULATE (99.5%) & SO2 (80%). THE BOILER CONTRACT HAS BEEN ARE NOW SCHEDULED FOR MAY 1981 AND MAY 1983. THE BOILER CONTRACT HAS BEEN AWARDED TO BABCOCK AND WILCOX AND THE TURBINE WILL BE SUPPLIED BY GENERAL ELECTRIC.
OTTER TAIL POWER COYOTE 1 400 MW - NEW LIGNITE 0.9 PERCENT SULFUR WHEELABRATOR-FRYE/A.I. AQUEOUS CARBONATE STARTUP 5/81	THIS NEW COAL-FIRED STATION IS JOINTLY OWNED BY FIVE UTILITIES. OTTER TAIL POWER IS THE MAJOR OWNER AND CONSTRUCTOR. MONTANA-DAKOTA UTILITIES IS THE FACILITY OPERATOR. THIS PLANNED UNIT WILL FIRE LOW SULFUR LIGNITE FROM THE MERCER COUNTY AREA IN A B&W CYCLONE BOILER. THE CONTRACT FOR THIS AQUEOUS CARBONATE/FABRIC FILTER SO2 SCRUBBER WAS AWARDED TO WHEELABRATOR-FRYE AND ATOMICS INTERNATIONAL. THE DRY REMOVAL SYSTEM COMBINES AI'S AQUEOUS CARBONATE PROCESS IN A W-F FABRIC FILTER. PLANT CONSTRUCTION BEGAN SEPT. 77. START-UP IS SET FOR MAY 81.
PACIFIC GAS AND ELECTRIC FOSSIL 1 800 MW - NEW COAL 0.8 PERCENT SULFUR VENDOR NOT SELECTED LIMESTONE STARTUP 0/84	PG&E ANNOUNCED PLANS TO BUILD TWO 800-MW COAL-FIRED POWER GENERATING UNITS IN NORTHERN CALIFORNIA. THE FIRST UNIT WILL BURN COAL WITH A HEATING VALUE OF 12000 BTU/LB, 0.8% SULFUR AND 10% ASH CONTENTS. THE SECOND UNIT WILL BURN COAL OF EQUAL OR BETTER QUALITY. THE EMISSION CONTROL SYSTEM WILL CONSIST OF AN ESP OR BAGHOUSE AND A LIMESTONE FGD SYSTEM. SLUDGE WILL BE DISPOSED OF IN A LANDFILL. START-UP DATES ARE 1984 AND 1985 FOR NOS. 1 AND 2 RESPECTIVELY.
PACIFIC GAS AND ELECTRIC FOSSIL 2 800 MW - NEW COAL 0.8 PERCENT SULFUR VENDOR NOT SELECTED LIMESTONE STARTUP 0/85	PG&E ANNOUNCED PLANS TO BUILD TWO 800-MW COAL-FIRED POWER GENERATING UNITS IN NORTHERN CALIFORNIA. THE FIRST UNIT WILL BURN COAL WITH A HEATING VALUE OF 12000 BTU/LB, 0.8% SULFUR AND 10% ASH CONTENTS. THE SECOND UNIT WILL BURN COAL OF EQUAL OR BETTER QUALITY. THE EMISSION CONTROL SYSTEM WILL CONSIST OF AN ESP OR BAGHOUSE AND A LIMESTONE FGD SYSTEM. SLUDGE WILL BE DISPOSED OF IN A LANDFILL. START-UP DATES ARE 1984 AND 1985 FOR NOS. 1 AND 2 RESPECTIVELY.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
PACIFIC POWER & LIGHT JIM BRIDGER 4 509 MW - NEW COAL 0.56 PERCENT SULFUR(AVG.) AIR CORRECTION DIVISION, UOP SODIUM CARBONATE STARTUP 9/79	THE AIR CORRECTION DIVISION OF UOP WAS AWARDED A CONTRACT FOR AN FGD SYSTEM AT THIS NEW-509 MW COAL-FIRED UNIT. THE FGD SYSTEM WILL CONSIST OF PARALLEL TRAY TOWER ABSORBER MODULES, EACH TREATING ONE-THIRD OF THE BOILER FLUE GAS AT FULL LOAD. AN ESP WILL PROVIDE PRIMARY PARTICULATE CONTROL. A CEILCOTE-LINED WET/DRY STACK IS INCLUDED IN THE SYSTEM. PPL'S PILOT STUDY INSPECTION REVEALED SCALE FORMATION PROBLEMS. TESTS ARE BEING CONDUCTED TO RESOLVE THIS PROBLEM. TO DATE, THE FOUNDATION IS IN AND VESSEL ERECTION IS 22 PERCENT COMPLETE.
PENNSYLVANIA POWER BRUCE MANSFIELD 1 825 MW - NEW COAL 4.7 PERCENT SULFUR CHEMICO LIME STARTUP 4/76	REFER TO SECTION 3 OF THIS REPORT FOR ADDITONAL INFORMATION. THIS EMISSION CONTROL SYSTEM WAS DESIGNED TO REMOVE FLYASH AND SO2 FROM 3.35 MM ACFM OF FLUE GAS USING THIOSORBIC LIME AS A SCRUBBING ABSORBENT. THE INITIAL SHAKEDOWN AND DEBUGGING PHASE OF OPERATION BEGAN FOR PART OF THE SYSTEM IN DECEMBER 1975. PARTIAL COMMERCIAL OPERATION COMMENCED IN APRIL 1976. THE UNIT WAS CERTIFIED FULL-LOAD COMMERCIAL IN JUNE 1976. THE FGD SYSTEM HAS EXPERIENCED OPERATIONAL PROBLEMS SINCE IT HAS BEEN IN SERVICE REQUIRING A NUMBER OF SYSTEM REPAIRS AND DESIGN MODIFICATINS.
PENNSYLVANIA POWER BRUCE MANSFIELD 2 825 MW - NEW COAL 4.7 PERCENT SULFUR CHEMICO LIME STARTUP 7/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THIS EMISSION CONTROL SYSTEM WAS DESIGNED TO REMOVE FLYASH AND SO2 FROM 3.35 MM ACFM OF FLUE GAS USING THIOSORBIC LIME AS A SCRUBBING ABSORBENT. SIX SCRUBBING TRAINS, EACH INCLUDING TWO VENTURI SCRUBBERS IN SERIES ARRANGEMENT, ARE PROVIDED FOR FULL-LOAD OPERATION. THE INITIAL SHAKEDOWN AND DEBUGGING PHASE OF OPERATION BEGAN FOR THREE TRAINS IN JULY, 1977. FULL COMMERCIAL OPERATION FOR THE ENTIRE SYSTEM COMMENCED ON OCTOBER 1, 1977.
PENNSYLVANIA POWER BRUCE MANSFIELD 3 825 MW - NEW COAL 4.7 PERCENT SULFUR PULLMAN KELLOGG LIME STARTUP 4/80	THE PULLMAN KELLOGG DIVISION OF PULLMAN INCORPORATED HAS BEEN AWARDED A CONTRACT FOR THE INSTALLATION OF AN FGD SYSTEM. THE EMISSION CONTROL SYSTEM FOR THIS UNIT WILL CONSIST OF ESP'S UPSTREAM OF FIVE WEIR HORIZONTAL CROSSFLOW WET SCRUBBING MODULES. CONSTRUCTION OF THE BOILER IS CURRENTLY IN PROGRESS. UNIT START-UP WILL BE IN APRIL 1980.
PHILADELPHIA ELECTRIC CROMBY 150 MW - RETROFIT COAL 2-4 PERCENT SULFUR UNITED ENGINEERS / PECO MAGNESIUM OXIDE STARTUP 6/80	THE UTILITY PLANS TO RETROFIT ONE OF THE TWO BOILERS AT CROMBY WITH AN FGD SYSTEM. HOWEVER, A FINAL DECISION HAS NOT BEEN MADE. THE SYSTEM BEING GIVEN PRIMARY CONSIDERATION IS MAGNESIUM OXIDE. ENGINEERING DESIGN WORK IS SCHEDULED TO COMMENCE SOON. TENTATIVE FGD SYSTEM START-UP IS SCHEDULED FOR JUNE 1980. CURRENTLY, PECO IS CONTINUING PROCESS EVALUATION STUDIES AT THE EDDYSTONE EXPERIMENTAL UNIT.
PHILADELPHIA ELECTRIC EDDYSTONE 1A 120 MW - RETROFIT COAL 2.5 PERCENT SULFUR UNITED ENGINEERS / PECO MAGNESIUM OXIDE STARTUP 9/75	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE EMISSION CONTROL SYSTEM FOR THIS UNIT CONSISTS OF THREE PARALLEL SCRUBBING TRAINS FOR THE CONTROL OF PARTICULATE AND SULFUR DIOXIDE. THE C-SIDE SCRUBBING TRAIN INCLUDES AN SO2 ABSORBER MODULE IN SERIES WITH A PARTICULATE SCRUBBER. APPROXIMATELY ONE-THIRD OF THE BOILER FLUE GAS IS SCRUBBED WITH MAGNESIUM OXIDE SLURRY FOR SO2 REMOVAL. THE SPENT SLURRY IS REGENERATED AT THE ESSEX SULFURIC ACID PLANT IN NEWARK, N.J. THE REGENERATED MAGOX IS RETURNED TO THE PLANT FOR SO2 SCRUBBING SERVICE.
PHILADELPHIA ELECTRIC EDDYSTONE 1B 240 MW - RETROFIT COAL 2.5 PERCENT SULFUR UNITED ENGINEERS / PECO MAGNESIUM OXIDE STARTUP 6/80	THE INSTALLATION OF AN FGD SYSTEM ON THE BALANCE OF THE FLUE GAS FROM THIS UNIT WILL FOLLOW PENDING THE OUTCOME OF THE PERFORMANCE OF THE EXPERIMENTAL SCRUBBING UNIT WHICH HAS BEEN INSTALLED AND CURRENTLY OPERATIONAL ON THIS UNIT. CURRENTLY, 3 PARTICULATE SCRUBBERS ARE TREATING THE FULL GAS LOAD FROM THIS UNIT.
PHILADELPHIA ELECTRIC EDDYSTONE 2 336 MW - RETROFIT COAL 2.4 PERCENT SULFUR UNITED ENGINEERS / PECO MAGNESIUM OXIDE STARTUP 6/80	THE UTILITY IS AWAITING PERFORMANCE RESULTS FROM THE EXPERIMENTAL FGD SYSTEM INSTALLED ON UNIT 1 AT THIS STATION BEFORE PROCEEDING WITH THE DESIGN OF AN FGD SYSTEM FOR THIS COAL-FIRED BOILER. THE SYSTEM BEING GIVEN PRIMARY CONSIDERATION IS MAGNESIUM OXIDE, DESIGNED JOINTLY BY UNITED ENGINEERS AND PHILADELPHIA ELECTRIC. ENGINEERING DESIGN WORK IS SCHEDULED TO COMMENCE SOON. TENTATIVE FGD SYSTEM START-UP IS SCHEDULED FOR JUNE 1980.

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SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
POTOMAC ELECTRIC POWER DICKERSON 4 800 MW - NEW COAL 2.0 PERCENT SULFUR VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 5/85	THERE ARE NO FIRM PLANS FOR INSTALLATION OF AN FGD SYSTEM. STARTUP DATE OF THE BOILER IS PLANNED FOR 1985. THIS UNIT WILL BURN 2 PERCENT SULFUR COAL WITH A HEATING VALUE OF 11,000 BTU/LB.
POWER AUTHORITY OF NEW YORK ARTHUR KILL PLANT 700 MW - NEW COAL - 3% SULFUR - REFUSE VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 11/84	THE UTILITY IS CONSIDERING BOTH REGENERABLE AND LIMESTONE FGD PROCESSES. FGD TECHNOLOGY IS BEING CONSIDERED FOR A FOSSIL FUEL BURNING UNIT WHICH WILL EMPLOY COAL AS THE PRIMARY FUEL AND OIL AS BACKUP. REFUSE WILL BE PROVIDED AS A SUPPLEMENTAL FUEL SUPPLY. THE PREFERRED PLANT SITE IS THE ARTHUR KILL FACILITY LOCATED ON STATEN ISLAND. THE PROJECT DESIGN ENGINEERING FIRM IS SARGENT AND LUNDY. PUBLIC SERVICE COMMISSION HEARINGS ARE IN PROGRESS.
PUBLIC SERVICE OF INDIANA GIBSON 5 650 MW - NEW COAL 3.3 PERCENT SULFUR VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 0/82	THE UTILITY IS IN THE PROCESS OF PREPARING SPECIFICATIONS. SCHEDULED START-UP OF THIS 650 MW UNIT IS 1982.
PUBLIC SERVICE OF NEW MEXICO SAN JUAN 1 314 MW - NEW COAL 0.8 PERCENT SULFUR DAVY POWERGAS/ALLIED CHEMICAL WELLMAN LORD STARTUP 4/78	THIS FGD SYSTEM IS AN INTEGRATION OF THE WELLMAN LORD SO2 RECOVERY PROCESS OF DAVY POWERGAS AND ALLIED CHEMICAL'S SO2 REDUCTION TO SULFUR PROCESS. A HOT SIDE ELECTROSTATIC PRECIPITATOR PRECEDES THE FGD SYSTEM. OF THE FOUR ABSORBER TOWERS INSTALLED THREE ARE NEEDED TO CARRY THE FULL LOAD. MOLTEN SULFUR WILL BE STORED ON THE PLANT SITE. THE INSTRUMENTATION CONTROL PROBLEM PREVIOUSLY REPORTED HAS BEEN SOLVED. CONSTRUCTION IS NOW COMPLETE. FLUE GAS FIRST ENTERED THE FGD SYSTEM APRIL 8, 1978.
PUBLIC SERVICE OF NEW MEXICO SAN JUAN 2 306 MW - RETROFIT COAL 0.8 PERCENT SULFUR DAVY POWERGAS/ALLIED CHEMICAL WELLMAN LORD STARTUP 7/78	CONSTRUCTION IS NEARING COMPLETION. START-UP IS NOW SCHEDULED FOR JULY 1978. THIS FGD SYSTEM IS AN INTEGRATION OF THE WELLMAN LORD SO2 RECOVERY PROCESS OF DAVY POWERGAS AND ALLIED CHEMICAL'S SO2 REDUCTION TO SULFUR PROCESS. A HOT SIDE ELECTROSTATIC PRECIPITATOR WILL PRECEDE THE FGD SYSTEM. FOUR ABSORBER TOWERS WILL BE INSTALLED FOR THIS UNIT. THREE WILL CARRY THE FULL LOAD. MOLTEN SULFUR WILL BE STORED ON THE PLANT SITE. START-UP DELAY WAS CAUSED BY A BOILER EXPLOSION. THE POWER PLANT HAS NOW RETURNED TO SERVICE.
PUBLIC SERVICE OF NEW MEXICO SAN JUAN 3 468 MW - NEW COAL 0.8 PERCENT SULFUR DAVY POWERGAS WELLMAN LORD STARTUP 1/81	THE UTILITY AWARDED A CONTRACT TO DAVY POWERGAS FOR ONE MODULE WHICH WILL BRING THE UNIT INTO COMPLIANCE WITH NSPS BY JAN. 1979. THE FGD SYSTEM FOR THE REMAINDER OF THE FLUE GAS FROM THIS 500-MW UNIT HAS NOT BEEN SELECTED. PRIMARY PARTICULATE CONTROL WILL BE EFFECTED BY AN UPSTREAM ESP. THE SINGLE MODULE IS CURRENTLY UNDER CONSTRUCTION. CONTRACT NEGOTIATIONS ARE CURRENTLY UNDERWAY FOR THE BALANCE OF THE UNIT 3 FGD SYSTEM AND FOR THE ENTIRE UNIT 4 SYSTEM.
PUBLIC SERVICE OF NEW MEXICO SAN JUAN 4 472 MW - NEW COAL 0.8 PERCENT SULFUR DAVY POWERGAS WELLMAN LORD STARTUP 1/82	THE UTILITY HAS PLACED A HOLD ON FURTHER ENGINEERING DESIGN WORK AT THE PRESENT TIME. THE PRESENT PLANS INCLUDE A WELLMAN LORD SO2 RECOVERY PROCESS. AN ESP WILL BE PROVIDED UPSTREAM OF THE FGD SYSTEM FOR PRIMARY PARTICULATE CONTROL. CONTRACT NEGOTIATIONS ARE CURRENTLY UNDERWAY IN CONJUNCTION WITH UNIT 3. THE PROJECTED START-UP DATE FOR UNIT 4 IS MAY 1982.
SALT RIVER PROJECT CORONADO 1 350 MW - NEW COAL 1.0 PERCENT SULFUR (MAX) PULLMAN KELLOGG LIMESTONE STARTUP 4/79	THIS NEW UNIT WILL BURN LOW SULFUR WESTERN COAL. A MAXIMUM OF 80% OF THE FLUE GAS WILL BE SCRUBBED TO MEET SULFUR DIOXIDE EMISSION REGULATIONS. PULLMAN/KELLOGG WILL PROVIDE 2 WEIR HORIZONTAL SPRAY TOWERS UTILIZING LIMESTONE SLURRY FOR SO2 CONTROL. THE SYSTEM WILL UTILIZE RUBBER-LINED SLURRY RECYCLE PUMPS, EACH RATED AT 9800 GPM, RIGIFLAKE-LINED SCRUBBER MODULES, VERTICAL HEIL MIST ELIMINATORS AND A MINIMUM OF 20 PERCENT REHEAT. THE SLUDGE WILL BE PONDED. THE FOUNDATION IS IN AND STRUCTURAL WORK IS 70 PERCENT COMPLETE.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
SALT RIVER PROJECT CORONADO 2 350 MW - NEW COAL 1.0 PERCENT SULFUR (MAX) PULLMAN KELLOGG LIMESTONE STARTUP 4/80	THIS NEW UNIT WILL BURN LOW SULFUR WESTERN COAL. A MAXIMUM OF 80% OF THE FLUE GAS WILL BE SCRUBBED TO MEET SULFUR DIOXIDE EMISSION REGULATIONS. PULLMAN/KELLOGG WILL PROVIDE 2 WEIR HORIZONTAL SPRAY TOWERS UTILIZING LIMESTONE SLURRY FOR SO2 CONTROL. THE SYSTEM WILL UTILIZE RUBBER-LINED SLURRY RECYCLE PUMPS, EACH RATED AT 9800 GPM, RIGIFLAKE-LINED SCRUBBER MODULES, VERTICAL HEIL MIST ELIMINATORS AND A MINIMUM OF 20 PERCENT REHEAT. THE SLUDGE WILL BE PONDED. THE FOUNDATION IS IN AND STRUCTURAL WORK IS 50 PERCENT COMPLETE.
SALT RIVER PROJECT CORONADO 3 350 MW - NEW COAL 1.0 PERCENT SULFUR (MAX) VENDOR NOT SELECTED LIMESTONE STARTUP 0/87	THIS NEW UNIT WILL BURN LOW SULFUR WESTERN COAL. 80 PERCENT OF THE GAS WILL BE SCRUBBED TO MEET SULFUR DIOXIDE EMISSION REGULATIONS. THE UTILITY IS CURRENTLY CONSIDERING THE INSTALLATION OF TWO HORIZONTAL SPRAY TOWERS EMPLOYING A LIMESTONE SCRUBBING SOLUTION TO REMOVE SO2 FROM THE FLUE GAS. SCHEDULED COMMERCIAL OPERATION DATE IS 1987. PLANS FOR AN EMISSION CONTROL SYSTEM HAVE NOT BEEN FINALIZED. SLUDGE WILL PROBABLY BE PONDED.
SIKESTON BOARD OF MUNIC. UTIL. SIKESTON POWER STATION 235 MW - NEW COAL 2.8 PERCENT SUFUR BABCOCK & WILCOX LIMESTONE STARTUP 6/81	B&W WAS AWARDED A CONTRACT FOR THE BOILER AND AIR QUALITY CONTROL SYSTEM. 2.8 PERCENT SULFUR COAL IS TO BE BURNED. THE AQCS WILL CONSIST OF 2 ESP'S FOLLOWED BY 3 FGD MODULES, EACH CAPABLE OF HANDLING 50% OF THE BOILER LOAD; ONE WILL BE ON STAND-BY AT ALL TIMES. THE SIKESTON STATION WILL FEATURE A DOUBLE-LINED STACK, 2 PONDS (ONE FOR FLY ASH, ONE FOR SCRUBBER SLUDGE/BOTTOM-ASH DISPOSAL), AND 4 AXIAL FLOW FANS. NO STACK GAS REHEAT IS PLANNED. MAXIMUM FLUE GAS CAPACITY IS 748,390 ACFM @ 288 F. CONSTRUTION COMMENCED IN MAY 1978.
SOUTH CAROLINA PUBLIC SERVICE WINYAH 2 280 MW - NEW COAL 1.0 PERCENT SULFUR BABCOCK & WILCOX LIMESTONE STARTUP 7/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE EMISSION CONTROL SYSTEM FOR THIS UNIT CONSISTS OF A 100% CAPACITY ESP FOLLOWED BY A 50% CAPACITY LIMESTONE FGD SYSTEM. ONE FGD MODULE, CONSISTING OF A VENTURI SCRUBBER AND TRAY TOWER ABSORBER, REMOVES 70% OF THE INLET SO2. REHEAT IS SUPPLIED BY FLUE GAS BYPASS. THE SCRUBBING WASTES ARE DISCHARGED TO AN ON-SITE, UNLINED DIKED POND. THE NO. 2 UNIT COMMENCED INITIAL OPERATION IN JULY 1977. THE ACCEPTANCE TEST FOR COMMERCIAL CERTIFICATION WAS SUCCESSFULLY COMPLETED IN DECEMBER 1977.
SOUTH CAROLINA PUBLIC SERVICE WINYAH 3 300 MW - NEW COAL 2.3 PERCENT SULFUR BABCOCK & WILCOX LIMESTONE STARTUP 5/80	A CONTRACT HAS BEEN AWARDED TO BABCOCK AND WILCOX FOR THE INSTALLATION OF THE FGD SYSTEM ON THIS UNIT. PARTICULATE REMOVAL WILL BE PROVIDED BY RESEARCH COTTRELL ESP'S. THE BOILER IS COAL-FIRED DRY-BOTTOM UNIT WHICH WILL BURN COAL WITH A 2.3% SULFUR CONTENT AND HEAT VALUE OF 11,500 BTU/LB. THE GENERATING EQUIPMENT IS BEING SUPPLIED BY RILEY STOKER. 80% OF THE FLUE GAS WILL BE SCRUBBED AND 20% WILL BE BYPASSED FOR REHEAT. FGD SYSTEM CONSTRUCTION BEGAN IN MAY 1978 AND START-UP IS SCHEDULED FOR MAY, 1980.
SOUTHERN ILLINOIS POWER COOP MARION 4 184 MW - NEW COAL 3.0 PERCENT SULFUR BABCOCK & WILCOX LIMESTONE STARTUP 8/78	THE EMISSION CONTROL SYSTEM FOR THIS NEW COAL-FIRED BOILER CONSISTS OF AN ESP FOR PARTICULATE CONTROL FOLLOWED BY 2 SPRAY TOWERS FOR SO2 CONTROL. LIMESTONE SLURRY WILL BE USED AS THE SCRUBBING REAGENT. SIPC IS NOT PLANNING TO UTILIZE FLUE GAS REHEAT AND IS CURRENTLY PLANNING ON BRICK LINING FOR THE STACK. SIPC INTENDS TO USE A LANDFILL WITH ASH STABILIZATION OF WASTE FOR SLUDGE DISPOSAL. CURRENTLY, CONSTRUCTION IS NEARLY 100% COMPLETE AND THE SYSTEM HAS BEEN AIR TESTED. START-UP IS SCHEDULED FOR AUGUST, 1978.
SOUTHERN ILLINOIS POWER COOP MARION 5 300 MW - NEW COAL 3.0 PERCENT SULFUR VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 0/84	SOUTHERN ILLINOIS POWER COOP IS PLANNING A NEW COAL-FIRED UNIT FOR ITS MARION STATION. THE NEW UNIT WILL BE MARION NO. 5. THE PROCESS HAS NOT BEEN DECIDED WITH RESPECT TO SO2 REMOVAL. THE UNIT WILL FIRE 3.0% SULFUR COAL AND MAY START UP AS EARLY AS 1983.
SOUTHERN INDIANA GAS & ELEC A. B. BROWN 1 250 MW - NEW COAL 3.75 PERCENT SULFUR FMC CORPORATION DOUBLE ALKALI STARTUP 4/79	THE UTILITY HAS AWARDED A CONTRACT TO FMC FOR THE INSTALLATION OF A DOUBLE ALKALI SCRUBBING SYSTEM UTILIZING SODA ASH AND LIME. THIS UNIT IS A PART OF A NEW POWER STATION LOCATED IN WEST FRANKLIN, INDIANA. THE SYSTEM WILL PRODUCE FILTER CAKE AS A WASTE PRODUCT WHICH WILL BE DISPOSED OF IN AN ON-SITE LANDFILL. THE PARTICULATE EMISSIONS WILL BE CONTROLLED BY A BUELL-ENVIROTECH COLD-SIDE ESP. THE CONSTRUCTION WORK AND ENGINEERING IS 30% COMPLETE.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
SOUTHERN MISSISSIPPI ELECTRIC R. D. MORROW 1 180 MW - NEW COAL 1.0 PERCENT SULFUR RILEY STOKER / ENVIRONEERING LIMESTONE STARTUP 8/78	CONSTRUCTION OF THE WET LIMESTONE SCRUBBING SYSTEM IS 90 PERCENT COMPLETE. PARTICULATE WILL BE CONTROLLED BY A HIGH-EFFICIENCY ESP UPSTREAM OF THE SCRUBBING SYSTEM. DESIGN SULFUR DIOXIDE AND PARTICULATE REMOVAL EFFICIENCIES ARE 85 AND 99.6 PERCENT, RESPECTIVELY. A WATER SPRAY HAS BEEN ADDED IN THE BY-PASS DUCT TO PROTECT THE LINER FROM TEMPERATURE EXCURSION. SCRUBBER SLUDGE WILL BE STABILIZED WITH FLYASH AND DISPOSED ON THE PLANT SITE.
SOUTHERN MISSISSIPPI ELECTRIC R. D. MORROW 2 180 MW - NEW COAL 1.0 PERCENT SULFUR RILEY STOKER / ENVIRONEERING LIMESTONE STARTUP 10/78	CONSTRUCTION OF THE WET LIMESTONE SCRUBBING SYSTEM IS NEARING COMPLETION. PARTICULATES WILL BE CONTROLLED BY A HIGH-EFFICIENCY ESP UPSTREAM OF THE SCRUBBING SYSTEM. DESIGN SULFUR DIOXIDE AND PARTICULATE REMOVAL EFFICIENCIES ARE 85 AND 99.6 PERCENT, RESPECTIVELY. A WATER SPRAY HAS BEEN ADDED IN THE BY-PASS DUCT TO PROTECT THE LINER FROM TEMPERATURE EXCURSION. SCRUBBER SLUDGE WILL BE STABILIZED WITH FLYASH AND DISPOSED ON THE PLANT SITE.
SOUTHWESTERN ELECTRIC POWER HENRY W. PERKEY 1 720 MW - NEW LIGNITE AIR CORRECTION DIVISION, UOP LIMESTONE STARTUP 6/83	A CONTRACT FOR THE EMISSION CONTROL SYSTEM HAS BEEN AWARDED TO THE AIR CORRECTION DIVISION OF UOP. THE UNIT WILL INCLUDE TWO COLD-SIDE ESP'S FOR PARTICULATE REMOVAL AND A SPRAY TOWER STRATEGY UTILIZING A LIMESTONE SLURRY FOR SO2 CONTROL. START-UP IS EXPECTED BY JUNE 1983.
SPRINGFIELD CITY UTILITIES SOUTHWEST 1 200 MW - NEW COAL 3.5 PERCENT SULFUR AIR CORRECTION DIVISION, UOP LIMESTONE STARTUP 4/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE EMISSION CONTROL SYSTEM FOR THIS NEW COAL-FIRED UNIT CONSISTS OF A FOUR-FIELD HIGH EFFICIENCY ESP (99.6% DESIGN) AND 2 TURBULENT CONTACT ABSORBER MODULES (80% DESIGN) FOR THE CONTROL OF PARTICULATES AND SO2. BOTH THE ESP AND LIMESTONE FGD SYSTEM ARE SUPPLIED BY UOP. THE SCRUBBING WASTES ARE DEWATERED BY A ROTARY DRUM VACUUM FILTER AND THE FILTER CAKE IS HAULED AWAY TO A LANDFILL. INITIAL OPERATION OF THE FGD SYSTEM OCCURRED IN APRIL 77. IN SEPT. 77, THE UNIT SUCCESSFULLY COMPLETED COMPLIANCE TESTING.
SPRINGFIELD WATER LIGHT & PWR DALLMAN 3 190 MW - NEW COAL 3.0-4.3 PERCENT SULFUR RESEARCH COTTRELL LIMESTONE STARTUP 7/80	A CONTRACT HAS BEEN AWARDED TO RESEARCH COTTRELL FOR THE INSTALLATION OF A LIMESTONE FGD SYSTEM. REQUIRED SULFUR DIOXIDE REMOVAL EFFICIENCY IS 90 PERCENT. A SLUDGE DISPOSAL STRATEGY HAS NOT BEEN FINALIZED, BUT THE UTILITY IS CONSIDERING EITHER PONDING OR LANDFILL. CONSTRUCTION OF THE FGD SYSTEM SHOULD COMMENCE IN LATE 1978. FGD START-UP IS SCHEDULED FOR JULY 1980. BOILER OPERATION IS SCHEDULED TO COMMENCE IN JUNE 1978.
ST. JOE MINERALS CORP. G. F. WEATON 1 60 MW - RETROFIT COAL 3.0 PERCENT SULFUR BUREAU OF MINES CITRATE STARTUP 10/78	CONSTRUCTION CONTINUES ON THE CITRATE PROCESS SCRUBBING SYSTEM WHICH WILL CONTROL SO2 EMISSIONS FROM A 60-MW COAL-FIRED POWER GENERATING UNIT AT ST. JOE MINERALS. THIS UNIT PROVIDES POWER FOR THE LOCAL UTILITY GRID. FGD SYSTEM START-UP IS SCHEDULED FOR OCTOBER 1978. THE REGENERABLE FGD SYSTEM WILL PRODUCE ELEMENTAL SULFUR AS A BY-PRODUCT.
TENNESSEE VALLEY AUTHORITY SHAWNEE 10A 10 MW - RETROFIT COAL 2.9 PERCENT SULFUR AIR CORRECTION DIVISION, UOP LIME/LIMESTONE STARTUP 4/72	REFER TO THE BACKGROUND INFORMATION IN SECTION 3 OF THIS REPORT. THIS TURBULENT CONTACT ABSORBER (TCA) LIME/LIMESTONE SCRUBBING SYSTEM HAS BEEN OPERATIONAL SINCE APRIL 1972. THIS TEST PROGRAM IS FUNDED BY THE EPA WITH TVA AS THE CONSTRUCTOR AND FACILITY OPERATOR. THE BECHTEL CORP. OF SAN FRANCISCO IS THE MAJOR CONTRACTOR, TEST DIRECTOR, AND REPORT WRITER. DURING THE REPORT PERIOD, OPERATIONS WERE CONCUCTED WITH MGO ADDITION TO BOTH LIME AND LIMESTONE SLURRY CIRCULATING THROUGH THE UNIT.
TENNESSEE VALLEY AUTHORITY SHAWNEE 10B 10 MW - RETROFIT COAL 2.9 PERCENT SULFUR CHEMICO LIME/LIMESTONE STARTUP 4/72	REFER TO THE BACKGROUND INFORMATION IN SECTION 3 OF THIS REPORT. THIS VENTURI/SPRAY TOWER LIME/LIMESTONE SCRUBBING SYSTEM HAS BEEN OPERATIONAL SINCE APRIL 1972. THIS TEST PROGRAM IS FUNDED BY THE EPA WITH TVA AS THE CONSTRUCTOR AND FACILITY OPERATOR. THE BECHTEL CORP. OF SAN FRANCISCO IS THE MAJOR CONTRACTOR, TEST DIRECTOR, AND REPORT WRITER. DURING THE REPORT PERIOD, FORCED OXIDATION WAS EVALUATED ON FLY ASH-FREE FLUE GAS WITH LIME AND LIMESTONE SLURRY AS THE SCRUBBING AGENT.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
TENNESSEE VALLEY AUTHORITY WIDOWS CREEK 7 575 MW - RETROFIT COAL 3.7 PERCENT SULFUR COMBUSTION ENGINEERING LIMESTONE STARTUP 0/ 0	TENNESSEE VALLEY AUTHORITY ANNOUNCED THAT A CONTRACT HAS BEEN AWARDED TO COMBUSTION ENGINEERING FOR A LIMESTONE SLURRY SPRAY TOWER FGD SYSTEM. THE FGD SYSTEM WILL TREAT HIGH SULFUR COAL FLUE GAS. THE SPRAY TOWER ABSORBERS WILL BE CONSTRUCTED OF 317L STAINLESS STEEL. THE NO. 7 UNIT FIRES COAL WITH THE SAME CHARACTERISTICS AS THE COAL FIRED IN THE NO. 8 UNIT.
TENNESSEE VALLEY AUTHORITY WIDOWS CREEK 8 550 MW - RETROFIT COAL 3.7 PERCENT SULFUR TENNESSEE VALLEY AUTHORITY LIMESTONE STARTUP 5/77	REFER TO SECTION 3 OF THIS REPORT FOR ADDITIONAL INFORMATION. THE EMISSION CONTROL SYSTEM FOR THIS 550-MW COAL-FIRED POWER-GENERATING UNIT CONSISTS OF EXISTING ELECTROSTATIC PRECIPITATORS FOLLOWED BY FOUR PARALLEL SCRUBBING TRAINS, EACH CAPABLE OF HANDLING 25 PERCENT OF THE BOILER FLUE GAS FROM UNIT NO. 8. EACH TRAIN INCLUDES A RECTANGULAR-THROAT VENTURI SCRUBBER AND A GRID-TOWER ABSORBER SUPPLIED BY POLYCON. THE GRID TOWER CAN BE CONVERTED TO A MOBILE-BED TOWER IF GREATER SO2 REMOVAL IS REQUIRED.
TEXAS MUNICIPAL POWER AGENCY GIBBONS CREEK 1 400 MW - NEW LIGNITE - 1.06 PERCENT SULFUR COMBUSTION ENGINEERING LIMESTONE STARTUP 1/82	COMBUSTION ENGINEERING HAS AWARDED A CONTRACT TO DESIGN AND SUPPLY A 400-MW LIGNITE-FIRED BOILER, ESP, AND FGD SYSTEM AT GIBBONS CREEK STEAM ELECTRIC STATION UNIT NO. 1. THE BOILER WILL BURN 1.06% SULFUR LIGNITE. FLUE GAS WILL BE CLEANED OF PARTICULATES BY A COLD-SIDE ESP (99.73% EFFICIENCY). SO2 WILL BE REMOVED BY 3 SPRAY TOWER MODULES UTILIZING A LIMESTONE SLURRY (72.5 TO 87.5% EFFICIENCY). A CONTRACT HAS BEEN AWARDED TO IUCS FOR SLUDGE DISPOSAL. COMMERCIAL START-UP HAS BEEN SET FOR JANUARY 1982.
TEXAS POWER & LIGHT SANDOW 4 545 MW - NEW LIGNITE COMBUSTION ENGINEERING LIMESTONE STARTUP 7/80	COMBUSTION ENGINEERING HAS BEEN CHOSEN AS THE BOILER AND FGD VENDOR FOR THIS UNIT. BOILER CONSTRUCTION BEGAN ON SEPTEMBER 9, 1977. PARTICULATE REMOVAL EQUIPMENT WILL BE LOCATED ON THE COLD-SIDE OF THE AIR HEATER. SOME PORTION OF FLUE GAS WILL BYPASS THE SCRUBBER FOR REHEAT. THE SPENT SLURRY WILL BE PONDED AND WATER RECYCLED. FGD CONSTRUCTION IS SCHEDULED TO BEGIN NOVEMBER 1978.
TEXAS POWER & LIGHT TWIN OAKS 1 750 MW - NEW LIGNITE VENDOR NOT SELECTED LIMESTONE STARTUP 8/83	THIS UNIT WILL BE JOINTLY OWNED BY TP&L AND ALCOA. A FIRM DECISION HAS NOT BEEN MADE WHETHER TO INSTALL FGD FACILITIES. THIS IS PRIMARILY DUE TO THE FACT THAT SUCH A DECISION IS NOT YET REQUIRED IN THE UTILITIES PLANNING TIMETABLE.
TEXAS POWER & LIGHT TWIN OAKS 2 750 MW - NEW LIGNITE VENDOR NOT SELECTED LIMESTONE STARTUP 9/84	THIS UNIT WILL BE JOINTLY OWNED BY TP&L AND ALCOA. A FIRM DECISION HAS NOT BEEN MADE WHETHER TO INSTALL FGD FACILITIES. THIS IS PRIMARILY DUE TO THE FACT THAT SUCH A DECISION IS NOT YET REQUIRED IN THE UTILITIES PLANNING TIMETABLE.
TEXAS UTILITIES FOREST GROVE 1 750 MW - NEW LIGNITE VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 0/81	TEXAS UTILITIES REPORTED THAT A NEW 750-MW LIGNITE-FIRED UNIT IS IN THE EARLY PLANNING STAGE FOR THE FOREST GROVE STATION IN ATHENS, TEXAS. START-UP IS SCHEDULED FOR LATE 1981. THE BOILER WILL BE SUPPLIED BY THE BABCOCK & WILCOX COMPANY.
TEXAS UTILITIES MARTIN LAKE 1 793 MW - NEW COAL 1.0 PERCENT SULFUR RESEARCH COTTRELL LIMESTONE STARTUP 8/77	THIS NEW 793-MW POWER GENERATING UNIT FIRES TEXAS LIGNITE WHICH CONTAINS 0.9% SULFUR (AVG) AND 8.0% ASH (AVG). IN ORDER TO MEET FEDERAL NSPS THE UNIT HAS BEEN EQUIPPED WITH AN EMISSION CONTROL SYSTEM WHICH INCLUDES COLD-SIDE ESP'S AND A LIMESTONE FGD SYSTEM BOTH SUPPLIED BY RESEARCH-COTTRELL. THE FGD SYSTEM CONSISTS OF 6 PACKED/SPRAY TOWER ABSORBERS WHICH TREAT 75% OF THE TOTAL BOILER FLUE GAS. THE REMAINING FLUE GAS IS BYPASSED FOR REHEAT. TOTAL SO2 REMOVAL EFFICIENCY IS 70.5%. THE FLUE GAS CLEANING WASTES ARE STABILIZED AND DISPOSED IN AN ON-SITE, LINED POND.

SECTION 2
STATUS OF FGD SYSTEMS

UNIT IDENTIFICATION	CURRENT STATUS
TEXAS UTILITIES MARTIN LAKE 2 793 MW - NEW COAL 1.0 PERCENT SULFUR RESEARCH COTTRELL LIMESTONE STARTUP 5/78	THIS NEW 793-MW POWER GENERATING UNIT FIRES TEXAS LIGNITE CONTAINING 0.9% SULFUR (AVG.) AND 8% ASH (AVG.). TO MEET FEDERAL NSPS, THE UNIT WILL BE EQUIPPED WITH AN EMISSION CONTROL SYSTEM CONSISTING OF COLD-SIDE ESP'S AND A LIMESTONE FGD SYSTEM, BOTH SUPPLIED BY RESEARCH-COTTRELL. THE FGD SYSTEM CONSISTS OF 6 PACKED/SPRAY TOWER ABSORBERS WHICH WILL TREAT 75% OF THE TOTAL BOILER FLUE GAS. THE REMAINING GAS WILL BE BYPASSED FOR REHEAT. TOTAL DESIGN SO2 REMOVAL EFFICIENCY IS 70.5%. THE FLUE GAS CLEANING WASTES WILL BE STABILIZED AND DISPOSED IN AN ON-SITE, LINED POND.
TEXAS UTILITIES MARTIN LAKE 3 793 MW - NEW COAL 1.0 PERCENT SULFUR RESEARCH COTTRELL LIMESTONE STARTUP 12/78	THIS NEW 793-MW POWER GENERATING UNIT WILL FIRE TEXAS LIGNITE CONTAINING 0.9% SULFUR (AVG.) AND 8% ASH (AVG.). TO MEET FEDERAL NSPS, THE UNIT WILL BE EQUIPPED WITH AN EMISSION CONTROL SYSTEM CONSISTING OF COLD-SIDE ESP'S AND A LIMESTONE FGD SYSTEM, BOTH SUPPLIED BY RESEARCH-COTTRELL. THE FGD SYSTEM CONSISTS OF 6 PACKED/SPRAY TOWER ABSORBERS WHICH WILL TREAT 75% OF THE TOTAL BOILER FLUE GAS. THE REMAINING GAS WILL BE BYPASSED FOR REHEAT. TOTAL DESIGN SO2 REMOVAL EFFICIENCY IS 70.5%. THE FLUE GAS CLEANING WASTES WILL BE STABILIZED AND DISPOSED IN AN ON-SITE, LINED POND.
TEXAS UTILITIES MARTIN LAKE 4 793 MW - NEW COAL 1.0 PERCENT SULFUR RESEARCH COTTRELL LIMESTONE STARTUP 11/82	THE CONTRACT FOR THIS FGD SYSTEM HAS BEEN AWARDED TO RESEARCH-COTTRELL. THE BOILER IS NOW BEING ERECTED. START-UP IS SCHEDULED FOR THE FOURTH QUARTER OF 1982.
TEXAS UTILITIES MONTICELLO 3 750 MW - NEW LIGNITE 1.5 PERCENT SULFUR CHEMICO LIMESTONE STARTUP 5/78	THE EMISSION CONTROL SYSTEM FOR THIS UNIT CONSISTS OF A HIGH EFFICIENCY ESP AND A LIMESTONE FGD SYSTEM. THE ESP (POLLUTION CONTROL-WALTHER) IS PROVIDED FOR PRIMARY PARTICULATE CONTROL (99.56%). THE FGD SYSTEM CONSISTS OF LIMESTONE SCRUBBING SPRAY TOWERS (CHEMICO) AND WILL PROVIDE PRIMARY SO2 CONTROL (74%). THE FGD SYSTEM IS DESIGNED TO TREAT APPROXIMATELY 3MM SCFM OF FLUE GAS RESULTING FROM COAL WITH 1.5% SULFUR, 18.9% ASH AND 0.04% CL. THE FLUE GAS CLEANING WASTES WILL BE STABILIZED AND DISPOSED IN AN ON-SITE, LINED POND. FULL LOAD OPERATIONS ARE EXPECTED IN AUGUST '78.
UTAH POWER & LIGHT EMERY 1 400 MW - NEW COAL 0.5 PERCENT SULFUR CHEMICO LIME STARTUP 12/78	A CONTRACT HAS BEEN AWARDED TO THE CHEMICO AIR POLLUTION DIVISION FOR A PEBBLE LIME WET SCRUBBING SYSTEM ON THIS NEW UNIT. THE SCRUBBING SYSTEM IS DESIGNED TO OPERATE IN AN OPEN WATER LOOP MODE WITH AN SO2 REMOVAL EFFICIENCY OF 80 PERCENT FOR LOW SULFUR UTAH COAL. PRIMARY PARTICULATE CONTROL WILL BE PROVIDED BY AN ESP UPSTREAM OF THE SCRUBBERS. THE SCRUBBER SLUDGE WILL BE STABILIZED WITH FLYASH AND DISPOSED ON THE PLANT SITE. THE A-E DESIGN FIRM FOR THIS PROJECT IS STEARNS-ROGER. CONSTRUCTION IS NOW APPROXIMATELY 65% COMPLETE AT THIS UNIT.
UTAH POWER & LIGHT HUNTINGTON 1 415 MW - NEW COAL 0.5 PERCENT SULFUR CHEMICO LIME STARTUP 5/78	A CONTRACT WAS AWARDED TO CHEMICO AIR POLLUTION DIVISION FOR A LIME SCRUBBING SYSTEM ON THIS NEW UNIT. THE STATE OF UTAH REGULATIONS REQUIRE THE BEST AVAILABLE AND MOST COST EFFECTIVE TECHNOLOGY FOR SULFUR DIOXIDE REMOVAL. PRIMARY PARTICULATE REMOVAL WILL BE PROVIDED BY AN ESP INSTALLED UPSTREAM OF THE WET SCRUBBING SYSTEM. CONSTRUCTION IS COMPLETE AND INITIAL OPERATIONS BEGAN ON MAY 10, 1978. COMMERCIAL OPERATION IS EXPECTED TO BEGIN IN JULY, 1978.
VIRGINIA ELECTRIC & POWER MT. STORM 1147 MW - RETROFIT COAL VENDOR NOT SELECTED PROCESS NOT SELECTED STARTUP 0/ 0	THE UTILITY IS CURRENTLY WAITING FOR AN EPA DECISION REGARDING A WEST VIRGINIA STATE EMISSION CONTROL PROPOSAL. PLANS FOR SULFUR DIOXIDE CONTROL ARE TEMPORARILY AT A STANDSTILL PENDING THIS DECISION. NO CONSTRUCTION OR STARTUP DATES HAVE BEEN ESTABLISHED.
WISCONSIN POWER & LIGHT COLUMBIA 2 527 MW - NEW COAL 0.8 PERCENT SULFUR CHEMICO LIME/ALKALINE FLYASH STARTUP 1/80	A CONTRACT WILL SOON BE AWARDED TO CHEMICO FOR A LIME/FLYASH FGD SYSTEM. IT WILL CONSIST OF TWO SPRAY MODULES WITH A HOT-SIDE ESP FOR PARTICULATE REMOVAL. A CLOSED LOOP WATER SYSTEM IS ANTICIPATED WITH FLYASH STABILIZATION OF THE SLUDGE. A SLUDGE DISPOSAL POND LOCATED OFF-SITE IS BEING CONSIDERED. THE FGD SYSTEM IS BEING DESIGNED TO TREAT 60% OF THE FLUE GAS RESULTING FROM THE COMBUSTION OF LOW SULFUR COLSTRIP COAL. THE REMAINING 40% WILL BE BYPASSED FOR REHEAT. CURRENTLY, THE UTILITY IS MAKING TESTS TO STUDY ALTERNATE SO2 COMPLIANCE STRATEGIES.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		ARIZONA PUBLIC SERVICE
UNIT NAME		CHOLLA 1
UNIT LOCATION		JOSEPH CITY ARIZONA
UNIT RATING		115 MW
FUEL CHARACTERISTICS		COAL 0.44-1 PERCENT SULFUR
FGD VENDOR		RESEARCH COTTRELL
PROCESS		LIMESTONE
NEW OR RETROFIT		RETROFIT
START UP DATE		10/73
EFFICIENCY: PARTICULATES	(ACTUAL)	99.7 PERCENT
	(DESIGN)	99.7 PERCENT
SO2	(ACTUAL)	50-60 PERCENT
	(DESIGN)	58.5 PERCENT
WATER MAKE UP		OPEN LOOP 1.04 GPM/MW
SLUDGE DISPOSAL		EXISTING FLY ASH POND

OPERATING EXPERIENCE UPDATE:

MONTH	RELIABILITY (%) MODULE A	 MODULE B	COMMENTS
JAN. 78	97	91	THE FLOODED DISC SCRUBBER TANK HEADER FOR SLURRY LIMESTONE WAS REPAIRED AFTER BEING DAMAGED DURING THE OVERHAUL. THE BOILER WAS OPERATED ONLY 135 HRS. DURING JANUARY AS THE OVERHAUL HAD EXTENDED INTO THIS MONTH. THE A-SIDE AND B-SIDE SERVICE HOURS WERE 131 AND 123 HOURS RESPECTIVELY.
FEB. 78	99	88	SOME MINOR LEAK REPAIRS AFTER THE OVERHAUL/CLEANING TOOK PLACE DURING FEBRUARY. SERVICE HOURS WERE: BOILER = 642, A-SIDE = 636, B-SIDE = 564.
MAR. 78	74	74	ONE FORCED SHUTDOWN OCCURRED ON THE A-SIDE. SERVICE HOURS WERE: BOILER = 744, A-SIDE = 744, B-SIDE = 735.
APR. 78	100	70	A MINOR LEAK REPAIR WAS NECESSARY AFTER AN OVERHAUL/CLEANING. SERVICE HOURS WERE: BOILER = 720, A-SIDE = 667, B-SIDE = 720.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		ARIZONA PUBLIC SERVICE
UNIT NAME		CHOLLA 2
UNIT LOCATION		JOSEPH CITY ARIZONA
UNIT RATING		250 MW
FUEL CHARACTERISTICS		COAL 0.44-1 PERCENT SULFUR
FGD VENDOR		RESEARCH COTTRELL
PROCESS		LIMESTONE
NEW OR RETROFIT		NEW
START UP DATE		6/78
EFFICIENCY:		
PARTICULATES	(ACTUAL)	
	(DESIGN)	99.7 PERCENT
SO2	(ACTUAL)	
	(DESIGN)	75.0 PERCENT
WATER MAKE UP		OPEN LOOP
SLUDGE DISPOSAL		DIKED/LINED SOLAR EVAPORATION

OPERATING EXPERIENCE UPDATE:

APRIL-MAY 1978 - THE SCRUBBER ON UNIT 2 IS NOW WORKING MOST OF THE TIME AND IS THEREFORE CONSIDERED TO BE OPERATIONAL. SOME PROBLEMS HAVE OCCURRED WITH VIBRATIONS THROUGH THE SYSTEM. THE EPA HAS GRANTED THE UTILITY AN EXTENSION FOR COMPLIANCE. THE COMPLIANCE TEST SHOULD BE COMPLETED BY AUGUST 15 WHICH IS THE DATE THAT HAS NOW BEEN SET FOR COMERCIAL START-UP.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME	COLUMBUS & SOUTHERN OHIO ELEC.
UNIT NAME	CONESVILLE 5
UNIT LOCATION	CONESVILLE OHIO
UNIT RATING	400 MW
FUEL CHARACTERISTICS	COAL 4.5 - 4.9 PERCENT SULFUR
FGD VENDOR	AIR CORRECTION DIVISION, UOP
PROCESS	LIME
NEW OR RETROFIT	NEW
START UP DATE	1/77

EFFICIENCY:

PARTICULATES	(ACTUAL)	
	(DESIGN)	99.6 PERCENT
SO2	(ACTUAL)	
	(DESIGN)	89.5 PERCENT

WATER MAKE UP	OPEN LOOP
SLUDGE DISPOSAL	PUMPED TO A LANDFILL

OPERATING EXPERIENCE UPDATE:

	OPERATION TIME (HR)			
PERIOD	BOILER	A-SIDE	B-SIDE	COMMENTS
JAN. 78		0	0	
ALL INDEX VALUES = 0 PERCENT				
FEB. 78				THE UNIT WAS SHUTDOWN FOR OVERHAUL THROUGH FEBRUARY AND STARTED UP ON MARCH 16.
ALL INDEX VALUES = 0 PERCENT				
MAR. 78	379	72	60	IMPURITIES IN LIME HAVE CAUSED PLUGGING PROBLEMS. PH CONTROLS AND SO2 ANALYSERS HAVE GIVEN SOME OPERATIONAL PROBLEMS.
AVAILABILITY (%) =		20	20	
OPERABILITY (%) =		64	54	
RELIABILITY (%) =		19	16	
UTILIZATION (%) =		19	16	
APR. 78	716			THE SYSTEM WAS DOWN DUE TO AN EXCESS OF FLOCCULANT IN THE THICKENER. THIS CAUSED A HIGH AMOUNT OF SOLIDS IN THE OVERFLOW THAT RESULTED IN PLUGGING PROBLEMS IN THE ABSORBER MODULES.
AVAILABILITY (%) =		67	65	
OPERABILITY (%) =		58	59	
RELIABILITY (%) =		61	63	
UTILIZATION (%) =		58	59	
MAY 78	720			THE SYSTEM WAS TAKEN OUT OF SERVICE BECAUSE OF CONTINUED PROBLEMS WITH THE FLOCCULANT FEED SYSTEM. THE THICKENER WAS EMPTIED TO RESTORE PROPER FLOCCULANT BALANCE. FLOCCULANT WAS CLEANED OUT.
AVAILABILITY (%) =		52	54	
OPERABILITY (%) =		45	50	
RELIABILITY (%) =		45	51	
UTILIZATION (%) =		44	49	

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		COLUMBUS & SOUTHERN OHIO ELEC.
UNIT NAME		CONESVILLE 6
UNIT LOCATION		CONESVILLE OHIO
UNIT RATING		400 MW
FUEL CHARACTERISTICS		COAL 4.5 - 4.9 PERCENT SULFUR
FGD VENDOR		AIR CORRECTION DIVISION, UOP
PROCESS		LIME
NEW OR RETROFIT		NEW
START UP DATE		4/78
EFFICIENCY:		
PARTICULATES	(ACTUAL)	
	(DESIGN)	99.6 PERCENT
SO2	(ACTUAL)	
	(DESIGN)	89.5 PERCENT
WATER MAKE UP		
SLUDGE DISPOSAL		PUMPED TO LANDFILL

OPERATING EXPERIENCE UPDATE:

FEB. 78
MAR. 78
THE UNIT IS CURRENTLY IN A PRE-OPERATIONAL PHASE. FULL COMMERCIAL OPERATION IS EXPECTED AFTER INITIAL START-UP PROBLEMS HAVE BEEN CORRECTED.

APR. 78
MAY 78
THE UNIT IS STILL IN A PRE-OPERATIONAL PHASE. FULL COMMERCIAL OPERATIONS WILL START IN JUNE.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME	DUQUESNE LIGHT	
UNIT NAME	ELRAMA POWER STATION	
UNIT LOCATION	ELRAMA PENNSYLVANIA	
UNIT RATING	510 MW	
FUEL CHARACTERISTICS	COAL 1.8-2.2 PERCENT SULFUR	
FGD VENDOR	CHEMICO	
PROCESS	LIME	
NEW OR RETROFIT	RETROFIT	
START UP DATE	10/75	
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99.0 PERCENT
	(DESIGN)	99.0 PERCENT
SO2	(ACTUAL)	60.0 PERCENT
	(DESIGN)	83.0 PERCENT
WATER MAKE UP	OPEN LOOP	
SLUDGE DISPOSAL	HAULAWAY TO OFF SITE LANDFILL	

OPERATING EXPERIENCE UPDATE:

	OPERATING HOURS						
PERIOD	BOILER	SCRUBBER-ABSORBER VESSELS					
		101	201	301	401	501	
JAN. 78		700	673	38	181	26	DURING THE PERIOD A NEW WORMER RECYCLE PUMP INSTALLED IN NOVEMBER EXPERIENCED JACK SHAFT BEARING PROBLEMS RESULTING IN THE REMOVAL OF TRAIN 501 FROM SERVICE. BOILER NO. 4 WAS CONNECTED ADDING AN ADDITIONAL 176 MW LOAD TO THE SYSTEM. THE IUCS SLUDGE DISPOSAL FACILITY IS NOW IN SERVICE. A LOW LOAD DEMAND AND THE COAL STRIKE HAVE HAMPERED SCRUBBER OPERATIONS. THERE IS SOME OUTAGE TIME SCHEDULED FOR MARCH.
FEB. 78		204	277	0	107	121	THE SYSTEM WAS SHUTDOWN ON FEB. 11 DUE TO A COAL SHORTAGE. THE FOLLOWING REPAIRS WERE MADE DURING THE OUTAGE WHICH CONTINUED THROUGH MARCH: * BOILER EXIT DAMPERS WERE LINED WITH 316 SS ON AREAS OF HIGH EROSION CAUSED BY FLYASH IMPINGEMENT. * EXPANSION JOINTS IN THE UPSTREAM DUCTWORK WERE SHIELDED BY METAL PLATES WHICH WERE WELDED AT ONE END. * EXPANSION JOINTS IN THE DOWNSTREAM DUCTWORK WERE COMPLETELY REPLACED. * THE DOWNSTREAM DUCTWORK WAS RELINED WITH CEILCOTE. * MODULE 401 INTERNALS WERE CLEANED AND SOME HOLES IN THE UPPER CONICAL REGION WERE REPAIRED. BOILERS 1, 2 AND 4 ARE NOW COMPLETELY CONNECTED TO THE FGD SYSTEM. BOILER 3 IS UNDERGOING AN EXTENSIVE OVERHAUL AND WILL BE CONNECTED TO THE SYSTEM IN LATE APRIL.
MAR. 78	0	0	0	0	0	0	

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                                                  EPA UTILITY FGD SURVEY: APRIL 1978 - MAY 1978

DUQUESNE LIGHT                                                ELRAMA POWER STATION
PERIOD      BOILER      SCRUBBER-ABSORBER VESSELS
                         101  201  301  401  501

APR. 78
MAY  78                                           BOILER 3 IS STILL BEING OVERHAULED.  ALL FGD SYS-
                                                  TEM CONSTRUCTION IS COMPLETE AND COMPLIANCE TEST-
                                                  ING WILL TAKE PLACE IN JULY WHEN UNIT 3 IS PUT IN
                                                  SERVICE.  THE PRELIMINARY TESTING CONDUCTED DURING
                                                  THE PERIOD VERIFIED SYSTEM SO2 REMOVAL EFFICIENCY.
                                                  NO HOURS WERE REPORTED DUE TO IRREGULAR SYSTEM
                                                  OPERATION DURING THE TESTING.
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SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME	DUQUESNE LIGHT
UNIT NAME	PHILLIPS POWER STATION
UNIT LOCATION	SOUTH HEIGHT PENNSYLVANIA
UNIT RATING	410 MW
FUEL CHARACTERISTICS	COAL 1.8-2.2 PERCENT SULFUR
FGD VENDOR	CHEMICO
PROCESS	LIME
NEW OR RETROFIT	RETROFIT
START UP DATE	7/73

EFFICIENCY:

PARTICULATES	(ACTUAL)	99.0 PERCENT
	(DESIGN)	99.0 PERCENT
SO2	(ACTUAL)	60.0 PERCENT
	(DESIGN)	83.0 PERCENT

WATER MAKE UP	OPEN LOOP
SLUDGE DISPOSAL	HAULAWAY TO OFF SITE LANDFILL

OPERATING EXPERIENCE UPDATE:

OPERATING HOURS

	BOILER						SCRUBBER-ABSORBER			
MONTH	1	2	3	4	5	6	101	201	301	401
JAN. 78							627	574	0	484
FEB. 78							209	287	18	152

AN OUTAGE OCCURRED BETWEEN JAN. 6 AND JAN. 8 WHEN THE STACK DRAIN LEAKS WERE REPAIRED BY SANDBLASTING THE OUTER WALL AND REPLACING THE CARBON STEEL BANDS WITH STAINLESS STEEL BANDS. THE SYSTEM WAS SHUTDOWN ON FEB. 11 DUE TO THE COAL SHORTAGE. THE OUTAGE CONTINUED THROUGH MARCH AND THE SYSTEM IS SCHEDULED TO BE ON LINE BY APRIL 15. DURING THE OUTAGE THE FOLLOWING REPAIRS AND MODIFICATIONS WERE MADE:

*THE BOILER EXIT DAMPERS WERE LINED WITH 316SS ON AREAS OF HIGH EROSION CAUSED BY FLYASH IMPINGEMENT.
*EXPANSION JOINTS ON THE INLET DUCTWORK WERE SHIELDED BY METAL PLATES WHICH WERE WELDED AT ONE END.
*NUMEROUS HOLES IN THE WET GAS DUCT WORK WERE REPAIRED AND THE DUCTS WERE RELINED WITH CEILCOTE.
*THE THROAT DAMPERS WERE CLEANED ON ALL THE SCRUBBERS.
*INTERNAL MIST ELIMINATORS WERE CLEANED. THE EXTERNAL MIST ELIMINATORS, WHICH ARE BADLY DETERIORATED, MAY BE REPLACED.
*THE STACK BRICKLINING WAS INSPECTED AND SOME BRICKS WERE REPLACED AT THE TOP OF THE STACK.

CONSTRUCTION WORK ON ADDITIONAL EQUIPMENT SUCH AS THE THICKENER AND SILOS IS ALMOST COMPLETE. IT WAS NOTED THAT THE CEILCOTE LINER COROLINE 505AR HAS HELD UP WELL OVER THREE YEARS ON THE CONICAL APEX OF MODULE 401.

MAR. 78

APR. 78

MAY 78

THE FGD SYSTEM CAME BACK ON LINE AFTER THE COAL STRIKE IN LATE MARCH. IT IS NOT OPERATING AT FULL LOAD BECAUSE THE NO. 6 BOILER IS STILL OUT AND SHOULD BE BACK ON LINE IN MID-JULY. COMPLIANCE TESTS WILL TAKE PLACE IN JULY, AFTER BOILER 6 IS BACK ON LINE, TO SEE IF THE SYSTEM IS MEETING THE 83% SO2 REMOVAL REQUIREMENT FOR 2% SULFUR COAL. THERE WERE NO HOURS REPORTED FOR THIS PERIOD BECAUSE OF PRELIMINARY TESTING BEING CONDUCTED IN PREPARATION FOR THE COMPLIANCE TESTS. SO FAR, TESTS INDICATE THAT THE SYSTEM WILL COMPLY WITH THE REQUIRED STANDARDS.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		INDIANAPOLIS POWER & LIGHT
UNIT NAME		PETERSBURG 3
UNIT LOCATION		PETERSBURG INDIANA
UNIT RATING		530 MW
FUEL CHARACTERISTICS		COAL 3.0-3.5 PERCENT SULFUR
FGD VENDOR		UNIVERSAL OIL PRODUCTS
PROCESS		LIMESTONE
NEW OR RETROFIT		NEW
START UP DATE		10/77
EFFICIENCY:		
PARTICULATES	(ACTUAL)	
	(DESIGN)	99.3 PERCENT
SO2	(ACTUAL)	
	(DESIGN)	80.0 PERCENT
WATER MAKE UP		CLOSED LOOP
SLUDGE DISPOSAL		IUCS SLUDGE STABILIZATION

OPERATING EXPERIENCE UPDATE:

DECEMBER-JANUARY 1978 - OPERATION OF ALL FOUR MODULES WAS INITIATED IN DECEMBER 1977. A SUCCESSFUL 24-HOUR RUN WAS COMPLETED ON DEC. 16 AND 17 WITH MODULES "B", "C" AND "D" IN OPERATION. "A" MODULE HAD AN INOPERATIVE RECYCLE TANK AGITATOR. REPAIR OF THE AGITATOR WAS COMPLETED ON DEC. 22 AND MODULE A WAS PLACED IN INITIAL OPERATION. A 30-DAY RUN SCHEDULED TO BEGIN JAN. 11 WAS POSTPONED UNTIL MID-MARCH PENDING RESOLUTION OF PROBLEMS ASSOCIATED WITH THE FLY ASH REMOVAL SYSTEM. THE COLD WEATHER NECESSITATED THE ERECTION OF TEMPORARY ENCLOSURES AROUND SEGMENTS OF THE FGD SYSTEM UNTIL THE INSTALLATION OF HEAT TRACING COULD BE COMPLETED.

FEBRUARY-MARCH 1978 - THE MODULES DID NOT OPERATE DURING FEBRUARY AS REPAIRS WERE MADE TO LINES AND VALVES DAMAGED BY FREEZE-UPS DURING THE WINTER. DURING MARCH SOME SCHEDULED REPAIRS WERE MADE WHICH INCLUDED INSTRUMENTATION WORK, INSULATION INSTALLATION AND REPAIR OF A BROKEN PINION GEAR OF THE THICKENER. SYSTEM START-UP IS STILL BEING DELAYED BY PROBLEMS WITH THE FLY ASH HANDLING SYSTEM AND IS NOW EXPECTED TO BE IN MID-APRIL.

APRIL-MAY 1978 - THE UNIT CAME BACK ON LINE IN THE MIDDLE OF APRIL AFTER PROBLEMS WITH THE FLYASH HANDLING SYSTEM WERE CORRECTED. THE SYSTEM OPERATED UNTIL THE MAIN POWER TRANSFORMER FAULTED, CAUSING THE SYSTEM TO GO DOWN. THE OUTAGE LASTED UNTIL JUNE 16. PROBLEMS HAVE ALSO BEEN EXPERIENCED WITH ALL CONTROL VALVES AND PIPING. THE VALVES HAD TO BE SENT BACK TO THE FACTORY FOR MODIFICATIONS.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		KANSAS CITY POWER & LIGHT
UNIT NAME		HAWTHORN 3
UNIT LOCATION		KANSAS CITY MISSOURI
UNIT RATING		140 MW
FUEL CHARACTERISTICS		COAL 0.5-3.5 PERCENT SULFUR
FGD VENDOR		COMBUSTION ENGINEERING
PROCESS		LIME
NEW OR RETROFIT		RETROFIT
START UP DATE		11/72
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99.0 PERCENT
	(DESIGN)	99.0 PERCENT
SO2	(ACTUAL)	
	(DESIGN)	70.0 PERCENT
WATER MAKE UP		OPEN LOOP 7.0 GPM/MW
SLUDGE DISPOSAL		PLANT SITE DISPOSAL POND

OPERATING EXPERIENCE UPDATE:

MONTH	PERIOD HRS.	BOILER HRS.	FGD SYSTEM HRS.	FGD SYSTEM AVAILABILITY (%)
FEB. 78	672	167	167	25
MAR. 78	744	406	406	56

DURING FEBRUARY THE UNIT WAS DOWN FOUR TIMES WITH ECONOMIZER AND WATER WALL LEAKS (OUTAGE TIME APROX. 504 HRS). A TWO WEEK OUTAGE WAS SCHEDULED DURING MARCH FOR SEASONAL MAINTENANCE. WATER WALL LEAK REPAIR AS WELL AS ACID CLEANING OF THE BOILER CAUSED ADDITIONAL OUTAGE TIME DURING THE LAST WEEK IN MARCH.

MONTH	PERIOD HRS.	BOILER HRS.	FGD SYSTEM HRS.	FGD SYSTEM AVAILABILITY (%)
APR. 78	720	548	220	76
MAY 78	744	403	403	42

AN AIR PREHEATER FIRE WAS DISCOVERED IN THE A MODULE ON MAY 12 CAUSING THAT MODULE TO BE DOWN THE REST OF THE MONTH.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME	KANSAS CITY POWER & LIGHT
UNIT NAME	HAWTHORN 4
UNIT LOCATION	KANSAS CITY MISSOURI
UNIT RATING	100 MW
FUEL CHARACTERISTICS	COAL 0.5-3.5 PERCENT SULFUR
FGD VENDOR	COMBUSTION ENGINEERING
PROCESS	LIME
NEW OR RETROFIT	RETROFIT
START UP DATE	8/72

EFFICIENCY:

PARTICULATES	(ACTUAL)	99.0 PERCENT
	(DESIGN)	99.0 PERCENT
SO2	(ACTUAL)	
	(DESIGN)	70.0 PERCENT

WATER MAKE UP	OPEN LOOP 7.0 GPM/MW
SLUDGE DISPOSAL	PLANT SITE DISPOSAL POND

OPERATING EXPERIENCE UPDATE:

MONTH	PERIOD HRS.	BOILER HRS.	FGD SYSTEM HRS.	FGD SYSTEM AVAILABILITY (%)
FEB. 78	672	198	198	30
MAR. 78	744	471	471	63

THE UNIT WAS DOWN THREE TIMES DURING FEBRUARY FOR NON-SCRUBBER RELATED PROBLEMS. TWO OTHER OUTAGES WERE THE RESULT OF A FUEL SAFETY TRIP PROBLEM AND GENERAL SCRUBBER MAINTENANCE. IN MARCH THERE WERE THREE ECONOMIZER LEAK OUTAGES (APPOX. 231 HRS) AND THE SCRUBBER REQUIRED AN ADDITIONAL 32 HRS OF OUTAGE TIME FOR MAINTENANCE.

MONTH	PERIOD HRS.	BOILER HRS.	FGD SYSTEM HRS.	FGD SYSTEM AVAILABILITY (%)
APR. 78	720	288		40
MAY 78	744	421		44

FGD OUTAGE IN MAY WAS DUE TO A CLARIFIER PLUG-UP. APRIL OUTAGE TIME WAS SCHEDULED FOR ROUTINE MAINTENANCE AND GENERAL CLEANING. SYSTEM HOURS WILL BE AVAILABLE FOR THE NEXT REPORT.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME	KANSAS CITY POWER & LIGHT
UNIT NAME	LA CYGNE 1
UNIT LOCATION	LA CYGNE KANSAS
UNIT RATING	820 MW
FUEL CHARACTERISTICS	COAL 5.0 PERCENT SULFUR
FGD VENDOR	BABCOCK & WILCOX
PROCESS	LIMESTONE
NEW OR RETROFIT	NEW
START UP DATE	2/73

EFFICIENCY:

PARTICULATES	(ACTUAL)	98.2 PERCENT
	(DESIGN)	98.0 PERCENT
SO2	(ACTUAL)	80.1 PERCENT
	(DESIGN)	76.0 PERCENT

WATER MAKE UP	OPEN LOOP 1.4 GPM/MW
SLUDGE DISPOSAL	PLANT SITE DISPOSAL POND

OPERATING EXPERIENCE UPDATE:

		PERCENT AVAILABILITY-BY MODULE								
MONTH	BOILER HOURS	A	B	C	D	E	F	G	H	AVERAGE
FEB. 78	578	92	93	95	94	91	97	96	93	94
MAR. 78	741	95	95	90	95	94	95	89	93	93
	FGD OPERATIONS AT LA CYGNE WERE CONDUCTED DURING THE REPORT PERIOD WITH NO MAJOR PROBLEMS ENCOUNTERED.									
APR. 78	620	91	92	93	91	90	92	91	91	91
	THE BOILER WAS DOWN A TOTAL OF 100 HOURS IN APRIL. THIS TIME INCLUDED THREE OUTAGES DUE TO BOILER LEAKS AND LACK OF LOAD REQUIREMENT. MODIFICATIONS TO THE FGD SYSTEM WERE PERFORMED DURING THE OUTAGES WHICH INCLUDED CHANGING THE REHEAT TUBE BUNDLES.									
MAY 78	593	89	92	92	93	92	91	93	86	91
	IN MAY THE BOILER WAS DOWN TWICE FOR A TOTAL OF 151 HOURS. OUTAGES WERE AGAIN CAUSED BY BOILER LEAKS AND GENERAL MAINTENANCE AND REPAIRS ON THE FGD SYSTEM WERE CONTINUED.									

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME	KANSAS POWER & LIGHT	
UNIT NAME	LAWRENCE 4	
UNIT LOCATION	LAWRENCE KANSAS	
UNIT RATING	125 MW	
FUEL CHARACTERISTICS	COAL 0.5 PERCENT SULFUR	
FGD VENDOR	COMBUSTION ENGINEERING	
PROCESS	LIMESTONE	
NEW OR RETROFIT	RETROFIT	
START UP DATE	12/68	
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99+ PERCENT
	(DESIGN)	98.9 PERCENT
SO2	(ACTUAL)	90+ PERCENT
	(DESIGN)	73.0 PERCENT
WATER MAKE UP	OPEN LOAD	
SLUDGE DISPOSAL	PLANT SITE DISPOSAL POND	

OPERATING EXPERIENCE UPDATE:

FEB. 78 MAR. 78	THE FGD SYSTEM OPERATED DURING THE REPORT PERIOD WITH NO MAJOR PROBLEMS. THE THICKENER UNDERFLOW LINE IS STILL FROZEN AND TWO 3 INCH DIAMETER FIRE HOSES ARE BEING USED TO PUMP THE UNDERFLOW SOLIDS TO THE POND.
APR. 78 MAY 78	THE UTILTIY REPORTED THAT THE FGD SYSTEM AND THE BOILER RAN WITHOUT ANY OUTAGES DURING THIS PERIOD.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		KANSAS POWER & LIGHT
UNIT NAME		LAWRENCE 5
UNIT LOCATION		LAWRENCE KANSAS
UNIT RATING		400 MW
FUEL CHARACTERISTICS		COAL 0.5 PERCENT SULFUR
FGD VENDOR		COMBUSTION ENGINEERING
PROCESS		LIMESTONE
NEW OR RETROFIT		NEW
START UP DATE		11/71
EFFICIENCY:		
PARTICULATES	(ACTUAL)	
	(DESIGN)	98.9 PERCENT
SO2	(ACTUAL)	
	(DESIGN)	52.0 PERCENT
WATER MAKE UP		OPEN LOOP
SLUDGE DISPOSAL		PLANT SITE DISPOSAL POND

OPERATING EXPERIENCE UPDATE:

	OPERATING HOURS	
MONTHS	BOILER	FGD MODULES
FEB. 78		
MAR. 78		

THE ORIGINAL FGD SYSTEM WAS PULLED OFF LINE ON MARCH 20 SO THAT THE NEW SCRUBBER-ABSORBER SYSTEM COULD BE TIED INTO THE GAS PATH. THIS NEW SYSTEM CONSISTS OF TWO MODULES EACH WITH A ROD SECTION FOR PARTICULATE REMOVAL AND A SPRAY TOWER FOR SO2 REMOVAL. THE CAPACITY IS 210 MW EACH. INITIAL OPERATION SHOULD BEGIN BY THE FIRST OF MAY.

APR. 78		
MAY 78		

THE NEW UNIT WENT IN SERVICE ON APRIL 14 AND HAS RUN WELL WITH NO OUTAGES SINCE START-UP.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME	KENTUCKY UTILITIES	
UNIT NAME	GREEN RIVER 1,2 & 3	
UNIT LOCATION	CENTRAL CITY KENTUCKY	
UNIT RATING	64 MW	
FUEL CHARACTERISTICS	COAL 3.8 PERCENT SULFUR	
FGD VENDOR	AMERICAN AIR FILTER	
PROCESS	LIME	
NEW OR RETROFIT	RETROFIT	
START UP DATE	9/75	
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99.7 PERCENT
	(DESIGN)	99.7 PERCENT
SO2	(ACTUAL)	80-90 PERCENT
	(DESIGN)	80.0 PERCENT
WATER MAKE UP	OPEN LOOP 1.20 GPM/MW	
SLUDGE DISPOSAL	PLANT SITE DISPOSAL POND	

OPERATING EXPERIENCE UPDATE:

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             TOTAL             BOILER              MODULE              MODULE CALLED    HR. MODULE
PERIOD  PERIOD (HR)   OPERATION (HR)    AVAILABILITY (HR)    TO OPERATE (HR)    OPERATED

JAN. 78     744              537                 722                  537             170
AVAILABILITY = 97%
RELIABILITY = 32%
OPERABILITY = 32%
UTILIZATION = 23%
       DURING THE MONTHS OF DECEMBER AND JANUARY NUMEROUS FREEZE-UPS OCCURED.  AS ONE COMPONENT
       WAS THAWED ANOTHER WOULD FREEZE.  THE ABSORBER WAS AVAILABLE FOR FGD OPERATIONS BUT COULD NOT
       BE UTILIZED BECAUSE THE SLURRY LINE TO THE POND FROZE.  THE UNIT WENT DOWN AFTER ABOUT 170
       HOURS OF OPERATION IN JANUARY.  BECAUSE OF EMERGENCY CONDITIONS THE UTILITY CHOSE TO CONCEN-
       TRATE THEIR MAINTENANCE CREWS ON POWER GENERATION RATHER THAN FGD OPERATION.  UNDER NOR-
       MAL CONDITIONS THE RELATIVELY MINOR FGD SYSTEM PROBLEMS WOULD HAVE BEEN SOLVED MORE QUICKLY.
       IN LIGHT OF THIS THE SYSTEM HAS BEEN CONSIDERED AVAILABLE THROUGHOUT MOST OF THE PERIOD CON-
       CERNED.

FEB. 78     672              672                 672                    0               0
AVAILABILITY = 100%
RELIABILITY =
OPERABILITY =
UTILIZATION = 0%
       DURING THE FREEZE UP NUMEROUS GASKETS WERE TORN THROUGHOUT THE SYSTEM.  THE SYSTEM WAS SHUT
       DOWN COMPLETELY FOR REPAIR WORK.

MAR. 78     744              669                 744                    0               0
AVAILABILITY = 100%
RELIABILITY =
OPERABILITY =
UTILIZATION = 0%
       REPAIR WORK WILL CONTINUE UNTIL LATE APRIL 78 WHEN THE SCRUBBER-ABSORBER SYSTEM IS EXPECTED
       BACK ON LINE.

APR. 78     720              295                 296                  295             296
AVAILABILITY = 41%
RELIABILITY = 99%
OPERABILITY = 99%
UTILIZATION = 41%
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EPA UTILITY FGD SURVEY: APRIL 1978 - MAY 1978

KENTUCKY UTILITIES                                                    GREEN RIVER 1,2 & 3
              TOTAL             BOILER              MODULE              MODULE CALLED     NO. MODULE
PERIOD   PERIOD (HR)      OPERATION (HR)     AVAILABILITY (HR)      TO OPERATE (HR)     OPERATED

MAY  78       744                474                  474                  475               474
AVAILABILITY = 64%
RELIABILITY = 98%
OPERABILITY = 100%
UTILIZATION = 64%
      THE UTILTY EXPERIENCED RECYCLE TANK SCREEN PROBLEMS OVER THE PERIOD.
```

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		LOUISVILLE GAS & ELECTRIC
UNIT NAME		CANE RUN 4
UNIT LOCATION		LOUISVILLE KENTUCKY
UNIT RATING		178 MW
FUEL CHARACTERISTICS		COAL 3.5 - 4.0 PERCENT SULFUR
FGD VENDOR		AMERICAN AIR FILTER
PROCESS		LIME
NEW OR RETROFIT		RETROFIT
START UP DATE		8/76
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99.0 PERCENT
	(DESIGN)	99.0 PERCENT
SO2	(ACTUAL)	86-89 PERCENT
	(DESIGN)	85.0 PERCENT
WATER MAKE UP		OPEN LOOP
SLUDGE DISPOSAL		PLANT-SITE DISPOSAL POND

OPERATING EXPERIENCE UPDATE:

				PERFORMANCE FACTORS (%)	
PERIOD	HOURS	BOILER (HR)	FGD SYSTEM (HR)	OPERABILITY	UTILIZATION
FEB. 78	672	0	0	0	0
MAR. 78	744		249		34

THE UNIT WAS DOWN THE ENTIRE MONTH OF FEBRUARY DUE TO THE COAL SHORTAGE AND A LACK OF AVAILABLE LIME RESULTING FROM THE SEVERE WINTER WEATHER. THE UNIT CAME BACK ON LINE MARCH 21 AFTER WHICH TIME THE FGD SYSTEM WAS ON LINE DURING 95% OF THE BOILER HOURS THROUGH THE END OF MARCH.

APR. 78	720	303	303	100	47

DURING APRIL THE BOILER WAS DOWN FOR REPAIRS. THE UTILITY REPORTED THAT THE AVAILABILITY AND RELIABILITY WERE BOTH 100%.

MAY 78	744	352	115	35	12

THE BOILER WAS DOWN AGAIN IN MAY FOR REPAIRS. DURING THE BOILER OUTAGE A NUMBER OF MODIFICATIONS WERE MADE TO THE DAMPERS IN THE FGD SYSTEM. THE UTILITY REPORTED THAT THE FGD SYSTEM HAS BEEN RUNNING WELL SINCE THE MODIFICATIONS TOOK PLACE. THE AVAILABILITY AND RELIABILITY FOR MAY WERE 31 AND 35 PERCENT RESPECTIVELY.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		LOUISVILLE GAS & ELECTRIC
UNIT NAME		CANE RUN 5
UNIT LOCATION		LOUISVILLE KENTUCKY
UNIT RATING		183 MW
FUEL CHARACTERISTICS		COAL 3.5 - 4.0 PERCENT SULFUR
FGD VENDOR		COMBUSTION ENGINEERING
PROCESS		LIME
NEW OR RETROFIT		RETROFIT
START UP DATE		12/77
EFFICIENCY:		
PARTICULATES	(ACTUAL)	
	(DESIGN)	99.0 PERCENT
SO2	(ACTUAL)	
	(DESIGN)	85.0 PERCENT
WATER MAKE UP		CLOSED LOOP
SLUDGE DISPOSAL		PLANT-SITE DISPOSAL POND

OPERATING EXPERIENCE UPDATE:

DECEMBER-JANUARY 1978 - OPERATION OF THE FGD SYSTEM AT CANE RUN 5 BEGAN ON DECEMBER 29. INITIAL OPERATIONS WERE NOT CONTINUOUS. DURING OPERATION SOME OF THE CONTROLS WERE NOT WORKING PROPERLY AND MODIFICATIONS WERE NECESSARY.

FEBRUARY-MARCH 1978 - THE PLANT REMAINED OFF LINE THROUGHOUT FEBRUARY AND THEN RE-STARTED ON MARCH 24. THE BOILER OPERATED APPROXIMATELY 182 HOURS THROUGH THE END OF MARCH WITH THE FGD SYSTEM OPERATING APPROXIMATELY 91 HOURS. VARIOUS INITIAL START-UP PROBLEMS WERE STILL BEING ENCOUNTERED CAUSING FGD SYSTEM OUTAGES.

APRIL-MAY 1978 - DURING APRIL THE BOILER WAS ON LINE 669 HOURS, AND THE FGD SYSTEM OPERATED 648 OF THOSE HOURS. DURING MAY THE BOILER AND FGD SYSTEM OPERATED 432 AND 364 HOURS, RESPECTIVELY. FGD SYSTEM MODIFICATIONS HAVE BEEN TAKING PLACE IN PREPARATION FOR THE PERFORMANCE TESTS. THE ONLY PROBLEM THAT OCCURRED DURING TESTING WAS A POOR JOB OF DATA GATHERING BY THE DATA CREWS. THEY DID NOT ACCURATELY FOLLOW THE EPA TEST METHODS. THE UTILITY IS CONFIDENT THAT THE UNIT WOULD HAVE PASSED HAD THE CREW TAKEN THEIR DATA PROPERLY. THE UNIT IS NOW IN ITS PREOPERATIONAL PHASE.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		LOUISVILLE GAS & ELECTRIC
UNIT NAME		PADDYS RUN 6
UNIT LOCATION		LOUISVILLE KENTUCKY
UNIT RATING		65 MW
FUEL CHARACTERISTICS		COAL 3.5 - 4.0 PERCENT SULFUR
FGD VENDOR		COMBUSTION ENGINEERING
PROCESS		LIME
NEW OR RETROFIT		RETROFIT
START UP DATE		4/73
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99.0 PERCENT
	(DESIGN)	99.0 PERCENT
SO2	(ACTUAL)	80-99 PERCENT
	(DESIGN)	80.0 PERCENT
WATER MAKE UP		OPEN LOOP 0.7 GPM/MW
SLUDGE DISPOSAL		HAULAWAY TO BORROW PIT

OPERATING EXPERIENCE UPDATE:

SEP. 77 THROUGH MAR. 78 NOT OPERATIONAL	PADDY'S RUN NO. 6 DID NOT OPERATE THROUGH THIS PERIOD DUE TO A LACK OF POWER REQUIREMENT. *NOTE: THIS UNIT WILL BE RETIRED WHEN THE MILL CREEK NO. 3 UNIT BECOMES OPERATIONAL, WHICH IS SCHEDULED FOR JULY, 1978.
APR. 78 MAY 78	THIS PEAK LOAD UNIT WAS ONLY ON LINE A FEW HOURS DURING THE PERIOD. NO PROBLEMS WERE REPORTED.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		MINNKOTA POWER COOPERATIVE
UNIT NAME		MILTON R. YOUNG 2
UNIT LOCATION		CENTER NORTH DAKOTA
UNIT RATING		450 MW
FUEL CHARACTERISTICS		LIGNITE 0.7 PERCENT SULFUR
FGD VENDOR		ADL/COMBUSTION EQUIP ASSOCIATE
PROCESS		LIME/ALKALINE FLYASH
NEW OR RETROFIT		NEW
START UP DATE		9/77
EFFICIENCY:		
PARTICULATES	(ACTUAL)	
	(DESIGN)	99.6 PERCENT
SO2	(ACTUAL)	
	(DESIGN)	75.0 PERCENT
WATER MAKE UP		CLOSED LOOP
SLUDGE DISPOSAL		PLANT SITE/MINE FILL

OPERATING EXPERIENCE UPDATE:

FEBRUARY-MARCH 1978 - BOTH THE BOILERS AND FGD SYSTEM CAME BACK ON LINE FEB. 21 AFTER COMPLETION OF THE TURBINE REPAIRS. ONE SCRUBBER-ABSORBER FORCED DRAFT FAN HAD AN OIL LEAK AND A SHAFT ALIGNMENT PROBLEM. IT WAS TAKEN OFF THE LINE AND SHIPPED TO BUFFALO FORGE CO.'S PLANT FOR REPAIRS. THE AFFECTED MODULE WAS DOWN FROM FEB. 23 THROUGH APRIL 10, WHEN THE REPAIRED UNIT WAS RE-INSTALLED. THE VACUUM FILTER ON THE SECOND SCRUBBER-ABSORBER WAS MALFUNCTIONING, ALLOWING LARGER SIZE PARTICLES TO ESCAPE THE FILTER. THIS CAUSED THE RUBBER LINING DOWNSTREAM TO PEEL WHICH, IN TURN, CREATED A PLUGGING PROBLEM. E.I.M. COMANY ENGINEERS ARE PRESENTLY STUDYING THE PROBLEM AND HOPE TO INCORPORATE MODIFICATIONS TO IMPROVE THE PERFORMANCE OF THE FILTERS. THE COMPLIANCE TEST HAS AGAIN BEEN RESCHEDULED WITH THE EPA FOR THE END OF MAY.

APRIL-MAY 1978 - COMPLIANCE TESTING TOOK PLACE DURING THE WEEK OF JUNE 5. THE UTILITY IS CONFIDENT THAT THE UNIT PERFORMED WELL AND WILL BE CERTIFIED. THE REPORT SHOULD BE AVAILABLE TO THE UTILITY BY THE END OF JUNE. THE UNIT IS CURRENTLY DOWN WITH DAMPER PROBLEMS (DOWN ON THE 24TH OF JUNE). APPARENTLY THE CHAINS THAT PULL THE GUILLOTINE DAMPERS WERE TOO WEAK. THEY ARE BEING REPLACED.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		MONTANA POWER
UNIT NAME		COLSTRIP 1
UNIT LOCATION		COLSTRIP MONTANA
UNIT RATING		360 MW
FUEL CHARACTERISTICS		COAL 0.8 PERCENT SULFUR
FGD VENDOR		ADL/COMBUSTION EQUIP ASSOCIATE
PROCESS		LIME/ALKALINE FLYASH
NEW OR RETROFIT		NEW
START UP DATE		11/75
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99.5 PERCENT
	(DESIGN)	99.5 PERCENT
SO2	(ACTUAL)	75.0 PERCENT
	(DESIGN)	60.0 PERCENT
WATER MAKE UP		CLOSED LOOP
SLUDGE DISPOSAL		CLAY-LINED DIKED POND

OPERATING EXPERIENCE UPDATE:

FEB. 78
MAR. 78
NO INFORMATION WAS REPORTED BY THE UTILITY FOR THIS PERIOD.

APR. 78
MAY 78
THE UNIT WAS DOWN FOR MOST OF THE SPRING FOR A SCHEDULED OVERHAUL.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		MONTANA POWER
UNIT NAME		COLSTRIP 2
UNIT LOCATION		COLSTRIP MONTANA
UNIT RATING		360 MW
FUEL CHARACTERISTICS		COAL 0.8 PERCENT SULFUR
FGD VENDOR		ADL/COMBUSTION EQUIP ASSOCIATE
PROCESS		LIME/ALKALINE FLYASH
NEW OR RETROFIT		NEW
START UP DATE		87/60
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99.5 PERCENT
	(DESIGN)	99.5 PERCENT
SO2	(ACTUAL)	75.0 PERCENT
	(DESIGN)	60.0 PERCENT
WATER MAKE UP		CLOSED LOOP
SLUDGE DISPOSAL		

OPERATING EXPERIENCE UPDATE:

JAN. 78
FEB. 78
MAR. 78
NO INFORMATION WAS REPORTED BY THE UTILITY FOR THIS PERIOD.

APR. 78
MAY 78
THE UNIT WAS DOWN FOR MOST OF THE SPRING FOR A SCHEDULED OVERHAUL.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		NEVADA POWER
UNIT NAME		REID GARDNER 1
UNIT LOCATION		MOAPA NEVADA
UNIT RATING		125 MW
FUEL CHARACTERISTICS		COAL 0.5 - 1.0 PERCENT SULFUR
FGD VENDOR		ADL/COMBUSTION EQUIP ASSOCIATE
PROCESS		SODIUM CARBONATE
NEW OR RETROFIT		RETROFIT
START UP DATE		4/74
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99+ PERCENT
	(DESIGN)	99.0 PERCENT
SO2	(ACTUAL)	85-90 PERCENT
	(DESIGN)	85.0 PERCENT
WATER MAKE UP		OPEN LOOP 0.40 GPM/MW
SLUDGE DISPOSAL		SOLAR EVAPORATION POND

OPERATING EXPERIENCE UPDATE:

PERIOD	TOTAL (HR.)	BOILER OPERATION (HR.)	MODULE AVAILABLE (HR.)	HR. CALLED UPON TO OPERATE	OPERATION (HR.)
FEB. 78	672	389	654	309	292

AVAILABILITY = 97%
RELIABILITY = 94%
OPERABILITY = 75%
UTILIZATION = 43%

THE SCRUBBER-ABSORBER SYSTEM WAS OFF-LINE FOR APPROXIMATELY 18 HOURS DURING FEBRUARY DUE TO PLUGGED SENSING LINES AND A DUCT HI-LO PRESSURE TRIP. THE BOILER WENT OUT OF SERVICE ON ON FEBRUARY 17 FOR A THREE WEEK OUTAGE.

PERIOD	TOTAL (HR.)	BOILER OPERATION (HR.)	MODULE AVAILABLE (HR.)	HR. CALLED UPON TO OPERATE	OPERATION (HR.)
MAR. 78	744	355	207	355	207

AVAILABILITY = 28%
RELIABILITY = 58%
OPERABILITY = 58%
UTILIZATION = 28%

THE BOILER CAME BACK ON LINE MARCH 16 BUT PROBLEMS WITH THE GUILLOTINE SWITCHES DELAYED START-UP OF THE FGD SYSTEM UNTIL MARCH 22. FGD DOWNTIME WAS APPROXIMATELY 537 HOURS. A PROBLEM WAS ALSO ENCOUNTERED WITH THE REHEAT STEAM REGULATOR DURING MARCH.

PERIOD	TOTAL (HR.)	BOILER OPERATION (HR.)	MODULE AVAILABLE (HR.)	HR. CALLED UPON TO OPERATE	OPERATION (HR.)
APR. 78	720	560	720	541	541

AVAILABILITY = 100%
RELIABILITY = 100%
OPERABILITY = 97%
UTILIZATION = 75%

THERE WERE NO FGD SYSTEM FORCED OUTAGES. ALL DOWNTIME WAS BOILER RELATED (179 HRS.).

PERIOD	TOTAL (HR.)	BOILER OPERATION (HR.)	MODULE AVAILABLE (HR.)	HR. CALLED UPON TO OPERATE	OPERATION (HR.)
MAY 78	744	630	721	605	582

AVAILABILITY = 97%
RELIABILITY = 96%
OPERABILITY = 92%
UTILIZATION = 78%

THE UNIT WAS DOWN 132 HOURS FOR A PRODUCTION CONTROL OUTAGE, 7 HOURS FOR REPAIRS TO THE CONDENSER, AND 23 HOURS DUE TO HIGH TEMPERATURE ON I.D. FAN BEARING. (OUTAGES WERE BOILER RELATED.)

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME	NEVADA POWER	
UNIT NAME	REID GARDNER 2	
UNIT LOCATION	MOAPA NEVADA	
UNIT RATING	125 MW	
FUEL CHARACTERISTICS	COAL 0.5 - 1.0 PERCENT SULFUR	
FGD VENDOR	ADL/COMBUSTION EQUIP ASSOCIATE	
PROCESS	SODIUM CARBONATE	
NEW OR RETROFIT	RETROFIT	
START UP DATE	4/74	
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99+ PERCENT
	(DESIGN)	99.0 PERCENT
SO2	(ACTUAL)	85-90 PERCENT
	(DESIGN)	85.0 PERCENT
WATER MAKE UP	OPEN LOOP 0.40 GPM/MW	
SLUDGE DISPOSAL	SOLAR EVAPORATION POND	

OPERATING EXPERIENCE UPDATE:

PERIOD	TOTAL (HR.)	BOILER OPERATION (HR.)	MODULE AVAILABLE (HR.)	HR. CALLED UPON TO OPERATE	OPERATION (HR.)
FEB. 78	672	636	625	632	585

AVAILABILITY = 93%
RELIABILITY = 92%
OPERABILITY = 92%
UTILIZATION = 87%

FGD DOWNTIME DURING FEBRUARY WAS APPROXIMATELY 48 HOURS DUE TO A PLUGGED SENSING LINE AND A DUCT HI-LO PRESSURE TRIP. THE BOILER WAS OUT OF SERVICE 34 HOURS.

MAR. 78	744	672	726	614	595

AVAILABILITY = 98%
RELIABILITY = 97%
OPERABILITY = 89%
UTILIZATION = 80%

THERE WAS ONLY ONE FORCED FGD OUTAGE DURING MARCH WHICH LASTED APPROXIMATELY 18 HOURS. A SCHEDULED BOILER OUTAGE AT THE BEGINNING OF THE MONTH TO REMOVE ASH BUILDUP WAS CANCELLED.

APR. 78	720	320	720	317	317

AVAILABILITY = 100%
RELIABILITY = 100%
OPERABILITY = 98%
UTILIZATION = 44%

THERE WAS ONE SCHEDULED BOILER OUTAGE WHICH LASTED ABOUT 403 HOURS.

MAY 78	744	726	743	726	724

AVAILABILITY = 100%
RELIABILITY = 100%
OPERABILITY = 100%
UTILIZATION = 97%

THE BOILER WAS OFF FOR APPROXIMATELY 18 HOURS FOR REPAIRS ON THE MILL SPOKES. THE 2A SEC. BREAKER TRIPPED AND CAUSED AN OUTAGE OF ABOUT ONE HOUR.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		NEVADA POWER
UNIT NAME		REID GARDNER 3
UNIT LOCATION		MOAPA NEVADA
UNIT RATING		125 MW
FUEL CHARACTERISTICS		COAL 0.5 - 1.0 PERCENT SULFUR
FGD VENDOR		ADL/COMBUSTION EQUIP ASSOCIATE
PROCESS		SODIUM CARBONATE
NEW OR RETROFIT		NEW
START UP DATE		7/76
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99+ PERCENT
	(DESIGN)	99.0 PERCENT
SO2	(ACTUAL)	85-90 PERCENT
	(DESIGN)	85.0 PERCENT
WATER MAKE UP		OPEN LOOP 0.40 GPM/MW
SLUDGE DISPOSAL		SOLAR EVAPORATION POND

OPERATING EXPERIENCE UPDATE:

```
                                                  HR.
                 BOILER        MODULE           CALLED
          TOTAL OPERATION     AVAILABLE        UPON TO    OPERATION
PERIOD    (HR.)   (HR.)         (HR.)          OPERATE      (HR.)

FEB. 78    672     619           642             618         588
AVAILABILITY = 96%
RELIABILITY = 95%
OPERABILITY = 95%
UTILIZATION = 88%
        DURING FEBRUARY FAULTY WIRING CAUSED A HIGH VENTURI TEMPERATURE RESULTING IN AN INITIAL 16
        HOUR FGD SYSTEM OUTAGE.  THERE WAS A SECOND OUTAGE OF 13 HOURS TO CHECK THE VENTURI TEMPERA-
        TURE INDICATOR.  A THIRD OUTAGE WAS CAUSED BY PLUGGING OF THE MIX TANK WHICH MADE IT IMPOS-
        SIBLE TO MIX CHEMICALS.

MAR. 78    744     741           724             738         718
AVAILABILITY = 97%
RELIABILITY = 97%
OPERABILITY = 97%
UTILIZATION = 96%
        THE MIX TANK PROBLEM CONTINUED INTO MARCH CAUSING THE ONLY FGD DOWNTIME FOR THE MONTH
        (APROX. 20 HOURS).  A FURNACE HI-LO PRESSURE TRIP CAUSED A BOILER OUTAGE OF 6 HOURS.

APR. 78    720     704           699             650         629
AVAILABILITY = 97%
RELIABILITY = 97%
OPERABILITY = 89%
UTILIZATION = 87%
        THE FGD SYSTEM WAS DOWN APPROXIMATELY 21 HOURS FOR REPAIRS ON THE VENTURI EMERGENCY SPRAY
        SYSTEM.  THE BOILER WAS DOWN APPROXIMATELY 70 HOURS DURING APRIL.

MAY  78    744     646           724             514         494
AVAILABILITY = 97%
RELIABILITY = 96%
OPERABILITY = 77%
UTILIZATION = 66%
        THERE WAS A SCHEDULED OUTAGE OF 230 HOURS FOR BOILER MAINTENANCE, AND A FORCED OUTAGE OF
        20 HOURS DUE TO A FAULTY TEMPERATURE PROBE AT THE VENTURI.
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SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME	NORTHERN INDIANA PUB SERVICE
UNIT NAME	DEAN H. MITCHELL 11
UNIT LOCATION	GARY INDIANA
UNIT RATING	115 MW
FUEL CHARACTERISTICS	COAL 3.2-3.5 PERCENT SULFUR
FGD VENDOR	DAVY POWERGAS/ALLIED CHEMICAL
PROCESS	WELLMAN LORD/ALLIED CHEMICAL
NEW OR RETROFIT	RETROFIT
START UP DATE	11/76

EFFICIENCY:

PARTICULATES	(ACTUAL)	99.5 PERCENT
	(DESIGN)	99.5 PERCENT
SO2	(ACTUAL)	91.0 PERCENT
	(DESIGN)	90.0 PERCENT

WATER MAKE UP	CLOSED LOOP
SLUDGE DISPOSAL	ELEMENTAL SULFUR PRODUCT

OPERATING EXPERIENCE UPDATE:

MONTH	HOURS IN PERIOD	HOURS AVAILABLE	HOURS CALLED ON TO OPERATE	HOURS OPERATED	AVAILABILITY	RELIABILETY	UTILIZATION
NOV. 77	720	531	596	428	74	72	90

THE FGD UNIT OPERATED FOR 18 CONSECUTIVE DAYS, AVERAGING 90% SO2 REMOVAL WITH 285 LONG TONS OF SULFUR RECOVERED. FGD OPERATION WAS INTERRUPTED BY A UNIT 11 BOILER TUBE LEAK AND RESUMPTION OF FGD OPERATION WAS FURTHER DELAYED BY MAINTENANCE IN THE EVAPORATOR SECTION. MAINTENANCE WAS ALSO PERFORMED ON THE FLUE GAS ISOLATION DAMPER, FLUE GAS BOOSTER BLOWER, AND SO2 REDUCTION SECTION.

DEC. 77	768	379	272	0	49	0	0

THE FGD SYSTEM WAS NOT OPERATED DURING THIS PERIOD DUE TO ABNORMAL BOILER OPERATING CONDITONS RELATED TO HIGH SILICA LEVELS IN THE FEED WATER. THE HIGH SILICA LEVELS RSULTED FROM HIGH MAKE-UP WATER REQUIREMENTS DUE IN PART TO A HIGHER THAN NORMAL FGD PLANT USAGE, AS WELL AS UNIT 11 COAL FEED PROBLEMS AND A PRECIPITATOR MALFUNCTION. MAINTENANCE WAS PERFORMED ON THE FG BOOSTER BLOWER AND THE ABSORBER SOLUTION REGENERATION SECTION.

JAN. 78	720	576	0	0	80		0

THE FGD SYSTEM REMAINED DOWN THROUGHOUT JANUARY AS HIGH SILICA LEVELS IN THE UNIT 11 BOILER FEED WATER PERSISTED. MAINTENANCE WAS PERFORMED ON THE UNIT 11 PRECIPITATOR, THE FG BOOSTER BLOWER AND THE FGD SYSTEM SO2 COMPRESSOR.

FEB. 78	720	336	0	0	47		0

THE FGD SYSTEM WAS NOT OPERATED DUE TO ABNORMAL BOILER OPERATING CONDITIONS RELATED TO HIGH SILICA LEVELS IN THE BOILER FEED WATER, COUPLED WITH UNIT 11 COAL FEED PROBLEMS, STOP VALVE PROBLEMS, PRECIPITATOR MALFUNCTION AND A LEAKING BOILER TUBE AND WORK ON THE FLUE GAS ISOLATION DAMPER. MAINTENANCE WAS ALSO PERFORMED ON THE FG BOOSTER BLOWER, THE EVAPORATOR CIRCULATING PUMP AND THE SO2 SUPERHEATER PIPING.

MAR. 78	720	648	281	215	90	77	30

THE FGD SYSTEM OPERATED FOR TEN DAYS. OPERATION WAS INTERRUPTED BY SHUTDOWN OF THE UNIT 11 BOILER FOR REPAIR OF COAL GRINDING MILLS AND PRECIPITATORS. PROPER CONDITIONS COULD NOT BE RE-ESTABLISHED FOR RE-START OF FGD OPERATION BECAUSE OF COAL FEED AND GRINDING PROBLEMS CAUSED BY EXTREMELY POOR QUALITY COAL. MAINTENANCE WAS PERFORMED ON THE FG BOOSTER BLOWER AND OPERATING PROBLEMS WERE ENCOUNTERED WITH THE FLUE GAS ISOLATION DAMPER.

MONTH	HOURS IN PERIOD	HOURS AVAILABLE	HOURS CALLED ON TO OPERATE	HOURS OPERATED	AVAILABILITY	RELIABILITY	UTILIZATION
APR. 78	720	0	288	0	0	0	0

THE FG BOOSTER BLOWER WAS OUT OF SERVICE FOR THIS ENTIRE PERIOD FOR REBLADING. THE FGD SYSTEM WAS INOPERABLE. A FAILURE OF THE FLUE GAS ISOLATION DAMPER ALSO OCCURRED. A NEW SUPPLY OF HIGH SULFUR COAL WAS OBTAINED AND SUCCESSFULLY TESTED ON UNIT 11 BOILER. THIS COAL IS EXPECTED TO ALLEVIATE PAST DIFFICULTIES WITH THE COAL FEED AND GRINDING SYSTEM. MAINTENANCE WAS ALSO PERFORMED ON THE BOILER ID FANS, COAL FEEDING AND GRINDING SYSTEM AND THE FGD ABSORBER.

MONTH	HOURS IN PERIOD	HOURS AVAILABLE	HOURS CALLED ON TO OPERATE	HOURS OPERATED	AVAILABILITY	RELIABILITY	UTILIZATION
MAY 78	720	368	529	263	51	50	37

THE SO2 RECOVERY PORTION OF THE FGD SYSTEM OPERATED FOR 26 DAYS. THE COMPLETE FGD SYSTEM OPERATED FOR 11 DAYS. OPERATION WAS INTERRUPTED BY FAILURE OF THE FLUE GAS ISOLATION DAMPER, PROBLEMS WITH WET COAL WHICH REQUIRED THAT THE UNIT 11 BOILER OPERATE ON LOW SULFUR COAL FOR A SHORT PERIOD AND PLUGGING OF AN ENTRAINMENT SEPARATOR IN THE SO2 REDUCTION UNIT.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME	NORTHERN STATES POWER
UNIT NAME	SHERBURNE 1
UNIT LOCATION	BECKER MINNESOTA
UNIT RATING	710 MW
FUEL CHARACTERISTICS	COAL 0.8 PERCENT SULFUR
FGD VENDOR	COMBUSTION ENGINEERING
PROCESS	LIMESTONE/ALKALINE FLYASH
NEW OR RETROFIT	NEW
START UP DATE	3/76
EFFICIENCY:	
PARTICULATES (ACTUAL)	99+ PERCENT
(DESIGN)	99.0 PERCENT
SO2 (ACTUAL)	50-55 PERCENT
(DESIGN)	50.0 PERCENT
WATER MAKE UP	OPEN LOOP 1.13 GPM/MW
SLUDGE DISPOSAL	CLAY-LINED DISPOSAL POND

OPERATING EXPERIENCE UPDATE:

BOILER OPERATION TIME AND MODULE OPERABILITY (%)

PERIOD	BOILER HR.	101	102	103	104	105	106	107	108	109	110	111	112
FEB. 78	636	0	93	92	89	74	85	89	88	76	86	88	87

TOTAL SYSTEM AVAILABILITY = 92 PERCENT
MEGAWATT-HOURS GENERATED = 366,200

MODULE 101 WAS DOWN IN FEBRUARY FOR MODIFICATIONS TO THE SPRAY TOWER ABSORBER. A BULK ENTRAINMENT SEPARATOR WAS INSTALLED ALONG WITH A KOCH WASH TRAY. SPRAY NOZZLES WERE REPLACED. THE 2 IN. DIA. SS RODS IN THE PRIMARY CONTACTOR WERE REPLACED WITH 6 5/8 IN. DIA. CERAMIC COATED C.S. RODS. THE CERAMIC SLEEVES ARE 9/16IN. THICK. MODULES WHICH ARE SHOWING AVAILABILITY OF LESS THAN 80 PERCENT, ARE THOSE IN WHICH THE STRAINER MODIFICATIONS WERE PERFORMED.

MAR. 78	676	71	83	64	89	90	83	62	89	97	71	79	90

TOTAL SYSTEM AVAILABILITY = 92 PERCENT
MEGAWATT-HOURS GENERATED = 423,220

STRAINER MODIFICATIONS CONTINUED THROUGH MARCH AFFECTING THE AVAILABILITIES OF MODULES 101, 103, 107 AND 110.

APR. 78	713	92	87	87	44	81	85	91	86	92	91	87	52

TOTAL SYSTEM AVAILABILITY = 95 PERCENT
MEGAWATT-HOURS GENERATED = 464,520

THE REASON FOR LOW AVAILABILITY ON MODULE 104 AND 112 IN APRIL RESULTED FORM THE OUTAGE TIME NECESSARY FOR THE INSTALLATION OF STEEL STRAINER SCREENS.

MAY 78	635	61	86	85	86	89	64	62	83	82	71	87	79

TOTAL SYSTEM AVAILABILITY = 95 PERCENT
MEGAWATT-HOURS GENERATED = 380,010

THERE WERE NO MAJOR FGD RELATED OUTAGES DURING MAY.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		NORTHERN STATES POWER
UNIT NAME		SHERBURNE 2
UNIT LOCATION		BECKER MINNESOTA
UNIT RATING		710 MW
FUEL CHARACTERISTICS		COAL 0.8 PERCENT SULFUR
FGD VENDOR		COMBUSTION ENGINEERING
PROCESS		LIMESTONE/ALKALINE FLY ASH
NEW OR RETROFIT		NEW
START UP DATE		4/77
EFFICIENCY:		
PARTICULATES	(ACTUAL)	50-55 PERCENT
	(DESIGN)	99.0 PERCENT
SO2	(ACTUAL)	55.0 PERCENT
	(DESIGN)	50.0 PERCENT
WATER MAKE UP		OPEN LOOP 1.13 GPM/MW
SLUDGE DISPOSAL		CLAY-LINED DISPOSAL POND

OPERATING EXPERIENCE UPDATE:

BOILER OPERATION TIME AND MODULE OPERABILITY (%)

PERIOD	BOILER HR.	201	202	203	204	205	206	207	208	209	210	211	212
FEB. 78	620	83	85	55	91	89	76	71	89	85	81	97	60

TOTAL S:STEM AVAILABILITY = 92 PERCENT
MEGAWATT-HOURS GENERATED = 367,080

MODULES 203 AND 212 HAVE LOW AVAILABILITY DUE TO STRAINER MODIFICATIONS.

MAR. 78	744	82	92	90	83	78	85	91	62	83	78	88	89

TOTAL SYSTEM AVAILABILITY = 97 PERCENT
MEGAWATT-HOURS GENERATED = 483,750

IN SPITE OF STRAINER MODIFICATIONS ON MODULES 208 AND 210, THE SYSTEM GENERATED MAXIMUM MEGAWATT-HOURS AND TIED THE HIGHEST RECORDED AVAILABILITY OF 97 PERCENT.

APR. 78	719	70	82	90	84	91	83	84	86	78	90	67	85

TOTAL SYSTEM AVAILABILITY = 92 PERCENT
MEGAWATT-HOURS GENERATED = 436,420

DURING APRIL MODULE 201 WAS CONVERTED FOR USE WITH THE NEW SPRAY TOWER WHICH WAS INSTALLED.

MAY 78	120	97	94	80	90	90	89	90	92	28	91	78	14

TOTAL SYSTEM AVAILABILITY = 91 PERCENT
MEGAWATT-HOURS GENERATED = 70,070

THERE WERE LINER FAILURES (CEILCOTE) IN MOST OF THE MODULES DURING MAY. THE LINERS WERE REPAIRED BY THE CEILCOTE COMPANY AT THEIR OWN EXPENSE. THE INLET SEAL STRIPS WERE ALSO REPAIRED. THE UNIT WENT DOWN ON MAY 6 FOR THE FIRST YEAR BOILER AND TURBINE INSPECTION AND WAS DOWN FOR THE REMAINDER OF THE PERIOD.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME	PENNSYLVANIA POWER
UNIT NAME	BRUCE MANSFIELD 1
UNIT LOCATION	SHIPPINGPORT PENNSYLVANIA
UNIT RATING	825 MW
FUEL CHARACTERISTICS	COAL 4.7 PERCENT SULFUR
FGD VENDOR	CHEMICO
PROCESS	LIME
NEW OR RETROFIT	NEW
START UP DATE	4/76

EFFICIENCY:

PARTICULATES	(ACTUAL)	99.9 PERCENT
	(DESIGN)	99.8 PERCENT
SO2	(ACTUAL)	95.0 PERCENT
	(DESIGN)	92.1 PERCENT

WATER MAKE UP	OPEN LOOP
SLUDGE DISPOSAL	RESERVOIR LANDFILL

OPERATING EXPERIENCE UPDATE:

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                                         OPERATING HOURS
MONTH          BOILER                      FGD MODULES
                             A       B       C       D       E       F

NOV. 77      720            682     713     657      0       0       0
FGD AVAILABILITY FACTOR %    95      99      91      0       0       0
FGD OPERABILITY FACTOR %     95      99      91      0       0       0
FGD UTILIZATION FACTOR %     95      99      91      0       0       0
TOTAL FGD LOST GENERATION FACTOR = 52.5
       REMOVAL OF THE OLD COATING AND PRIMING OF THE FLUE LINING IN FLUE 1B IS PROCEEDING
       SLOWER THAN ANTICIPATED.  IT IS EXPECTED THAT TOTAL WORK ON THE FLUE WILL NOT BE COMPLETED
       UNTIL FEBRUARY OR MARCH 1978.

DEC. 77      626            677     592     675      0       0       0
FGD AVAILABILITY FACTOR % 100        93      99      0       0       0
FGD OPERABILITY FACTOR %  100        94     100      0       0       0
FGD UTILIZATION FACTOR %    91       79      91      0       0       0
TOTAL FGD LOST GENERATION FACTOR = 61 %
       SANDBLASTING OF UNIT 1-B FLUE IS NEARING COMPLETION.  THE FLUE WILL BE RELINED WITH P.P.G.
       CXL-2000.

JAN. 78      331
FGD AVAILABILITY FACTOR % 100         0     100      0       0       0
FGD OPERABILITY FACTOR %  100         0     100      0       0       0
FGD UTILIZATION FACTOR      58        0      58      0       0       0
TOTAL FGD LOST GENERATION FACTOR = 60%
       THERE WERE PROBLEMS WITH 1B FAN WHICH NECCESITATED EXTENSIVE REPAIRS.  LINING ABRASION AND
       DISBONDMENT IN FAN CAUSED CORROSION OF UNDERLYING SUPPORT METAL.  THE UNIT TRIPPED SEVERAL
       TIMES DUE TO DIFFICULTIES IN BURNING WET STOCKPILE COAL.

FEB. 78      514            534     410     551      0       0       0
FGD AVAILABILITY FACTOR %   79       61      82      0       0       0
FGD OPERABILITY FACTOR %  100        80     100      0       0       0
FGD UTILIZATION FACTOR %    79       61      82      0       0       0
TOTAL FGD LOST GENERATION FACTOR = 54%
       EXTENSIVE REPAIRS TO 1B I.D. FAN AND THE EMERGENCY NEED FOR LOAD FROM THE PLANT DURING THE
       COAL STRIKE TEMPORARILY OVERLOADED 1A AND 1C TRAINS.  THE MIST ELIMINATOR WILL BE REPLACED ON
       1C TRAIN AS A RESULT OF THIS.  1B FLUE RELINING CONTINUED.
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SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME	PENNSYLVANIA POWER
UNIT NAME	BRUCE MANSFIELD 2
UNIT LOCATION	SHIPPINGPORT PENNSYLVANIA
UNIT RATING	825 MW
FUEL CHARACTERISTICS	COAL 4.7 PERCENT SULFUR
FGD VENDOR	CHEMICO
PROCESS	LIME
NEW OR RETROFIT	NEW
START UP DATE	7/77

EFFICIENCY:

PARTICULATES	(ACTUAL)	99.9 PERCENT
	(DESIGN)	99.8 PERCENT
SO2	(ACTUAL)	95.0 PERCENT
	(DESIGN)	92.1 PERCENT

WATER MAKE UP	OPEN LOOP
SLUDGE DISPOSAL	RESERVOIR LANDFILL

OPERATING EXPERIENCE UPDATE:

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                                        OPERATING HOURS
MONTH       BOILER                        FGD MODULES
                          A        B        C        D        E        F

NOV. 77      581         598      584      533      331      304      246
FGD AVAILABILITY FACTOR % 100      96       88       47       55       47
FGD OPERABILITY FACTOR %  100     100       92       57       52       42
FGD UTILIZATION FACTOR %   83      81       74       46       42       34
TOTAL FGD LOST GENERATION FACTOR = 27%
       PROBLEMS ASSOCIATED WITH THE STATION POWER TRANSFORMERS CAUSED LIMITATION IN LOAD ON UNIT 2.
       THREE OF THE SIX STATION TRANSFORMERS FOR UNIT 2 WERE DESTROYED.

DEC. 77      607         469      638      618      644       513      565
FGD AVAILABILITY FACTOR %  74      99       98      100        89       99
FGD OPERABILITY FACTOR %   77     100      100      100        85       93
FGD UTILIZATION FACTOR %   63      86       83       86        69       76
TOTAL FGD LOST GENERATION FACTOR = 7.4%
       COLD WEATHER CREATED SOME FREEZING PROBLEMS WITH PROCESS PIPING.

JAN. 78      391
FGD AVAILABILITY FACTOR %  95     100       96       94        99       99
FGD OPERABILITY FACTOR %   58     100       56      100       100       96
FGD UTILIZATION FACTOR %   31      76       29       70        64       50
TOTAL FGD LOST GENERATION FACTOR = 4.3%
       UNIT TRIPPED SEVERAL TIMES DUE TO DIFFICULTIES IN BURNING WET STOCKPILE COAL.  BOILER
       CONTROL VALVE PROBLEMS ("W" VALVE) COMPOUNDED START-UP ATTEMPT DIFFICULTIES.  WHEN THE UNIT
       WAS ON LINE DURING THIS MONTH, THE WET COAL ALSO PREVENTED FULL LOAD OPERATION OF
       COAL MILLS.

FEB. 78      672         321      460      594      480       664      525
FGD AVAILABILITY FACTOR %  84      87       89       97        99       78
FGD OPERABILITY FACTOR %   46      68       88       71        99       78
FGD UTILIZATION FACTOR %   48      68       88       71        99       78
TOTAL FGD LOST GENERATION FACTOR = 18.6 %
       MANY PROBLEMS OCCURRED WITH I.D. FAN COOLERS DUE TO INCLEMENT WEATHER.
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SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		PHILADELPHIA ELECTRIC
UNIT NAME		EDDYSTONE 1A
UNIT LOCATION		EDDYSTONE PENNSYLVANIA
UNIT RATING		120 MW
FUEL CHARACTERISTICS		COAL 2.5 PERCENT SULFUR
FGD VENDOR		UNITED ENGINEERS / PECO
PROCESS		MAGNESIUM OXIDE
NEW OR RETROFIT		RETROFIT
START UP DATE		9/75
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99.9 PERCENT
	(DESIGN)	99.9 PERCENT
SO2	(ACTUAL)	95-97 PERCENT
	(DESIGN)	90.0 PERCENT
WATER MAKE UP		OPEN LOOP 1.1 GPM/MW
SLUDGE DISPOSAL		ACID PLANT REGENERATION

OPERATING EXPERIENCE UPDATE:

FEB. 78 MAR. 78	THE TURBINE OVERHAUL CONTINUED DURING THE REPORT PERIOD. DURING THE SHUTDOWN PERIOD IT WAS FOUND THAT SOME HIGH PRESSURE STEAM TUBES WERE CRACKED, SO UNIT MAINTENANCE HAS TAKEN LONGER THAN EXPECTED. SOME MINOR FGD SYSTEM MODIFICATIONS HAVE BEEN INCORPORATED IN THE COURSE OF THE SHUTDOWN PERIOD. START UP IS EXPECTED IN MID-APRIL 78.
APR. 78 MAY 78	THE UNIT JUST CAME BACK ON LINE JUNE 1 AFTER AN EXTENSIVE SYSTEM MODIFICATION OUTAGE WHICH BEGAN DECEMBER 22. THE UNIT WAS EXPECTED BACK ON LINE IN MID-APRIL, BUT THERE WAS A PROBLEM WITH A SUPER PRESSURE STEAM TURBINE.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		PUBLIC SERVICE OF NEW MEXICO
UNIT NAME		SAN JUAN 1
UNIT LOCATION		WATERFLOW NEW MEXICO
UNIT RATING		314 MW
FUEL CHARACTERISTICS		COAL 0.8 PERCENT SULFUR
FGD VENDOR		DAVY POWERGAS/ALLIED CHEMICAL
PROCESS		WELLMAN LORD
NEW OR RETROFIT		NEW
START UP DATE		4/78
EFFICIENCY:		
PARTICULATES	(ACTUAL)	
	(DESIGN)	99.8 PERCENT
SO2	(ACTUAL)	
	(DESIGN)	85.0 PERCENT
WATER MAKE UP		
SLUDGE DISPOSAL		

OPERATING EXPERIENCE UPDATE:

FEBRUARY-MARCH 1978 - INITIAL SO2 ABSORPTION AT SAN JUAN NO. 1 BEGAN ON APRIL 8, 1978. FULL COMMERCIAL OPERATION IS EXPECTED BY LATE JUNE. THE FGD SYSTEM IS CURRENTLY IN SERVICE WITH TWO OF THE UNIT'S FOUR ABSORBER CELLS OPERATING CONTINUOUSLY. A THIRD CELL IS TO BE BROUGHT ON LINE LATER. THREE CELLS WILL BE REQUIRED FOR FULL LOAD WITH A FOURTH INCLUDED FOR SPARE FGD CAPACITY. THE CURRENT MODE IS TO KEEP 2 CELLS IN SERVICE AT ALL TIMES AND 2 OUT OF SERVICE. 2/3 OF THE FLUE GAS IS BEING TREATED WHILE 1/3 IS BEING BYPASSED. THE UNIT IS IN COMPLIANCE AT PRESENT WITH RESPECT TO SO2 WITH ONLY 2 CELLS RUNNING BECAUSE THE BISULFITE CONCENTRATION HAS NOT YET BUILT UP IN THE ABSORBENT LIQUOR. WHEN THE SYSTEM REACHES EQUILIBRIUM WITH RESPECT TO BISULFITE (18% BISULFITE) THE UNIT WILL BE READY TO BEGIN REGENERATING OPERATIONS. REGENERATION IS EXPECTED TO BEGIN BY APRIL 27. COMPLIANCE TESTING MAY TAKE PLACE AS EARLY AS THE FIRST WEEK OF MAY.

APRIL-MAY 1978 - OVER THE PERIOD THE UTILITY ACCUMULATED 22 DAYS OF DATA DURING WHICH THE BOILER WAS DOWN FOR 7 HOURS AND THE ABSORBERS WERE DOWN FOR 28 HOURS (UNSCHEDULED). THE UNIT IS STILL NOT STABILIZED SO USEFUL FIGURES FOR WATER REQUIREMENTS ARE UNAVAILABLE. THE CHEMICAL PLANT REMAINS IN ITS START UP STAGE.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		SOUTH CAROLINA PUBLIC SERVICE
UNIT NAME		WINYAH 2
UNIT LOCATION		GEORGETOWN SOUTH CAROLINA
UNIT RATING		280 MW
FUEL CHARACTERISTICS		COAL 1.0 PERCENT SULFUR
FGD VENDOR		BABCOCK & WILCOX
PROCESS		LIMESTONE
NEW OR RETROFIT		NEW
START UP DATE		7/77
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99.4 PERCENT
	(DESIGN)	99.4 PERCENT
SO2	(ACTUAL)	85.0 PERCENT
	(DESIGN)	69.0 PERCENT
WATER MAKE UP		OPEN LOOP
SLUDGE DISPOSAL		ON-SITE POND

OPERATING EXPERIENCE UPDATE:

FEB. 78 MAR. 78	DURING THE FEB-MAR PERIOD THE FGD SYSTEM WAS BYPASSED ONCE FOR SEVERAL DAYS TO ALLOW SYSTEM CLEANING. THIS WAS IN PREPARATION FOR TESTS THAT BABCOCK AND WILCOX WILL SOON BE PERFORMING, AND FOR WHICH THEY HAVE SET UP TEMPORARY ON-SITE LABORATORY FACILITIES. OTHERWISE, THE SYSTEM RAN WELL DURING THE PERIOD WITH ONLY A FEW MINOR PLUGGING AND SPILLAGE PROBLEMS IN VARIOUS SLURRY LINES.
APR. 78 MAY 78	THE SYSTEM WAS OPERATIONAL FOR MOST OF THIS PERIOD. THE ONLY PROBLEM ENCOUNTERED WAS MINOR SCALING, BUT IT DID NOT CAUSE AN OUTAGE. THE UTILITY DID NOT HAVE ANY PERFORMANCE FACTORS TO REPORT FOR THIS PERIOD.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		SPRINGFIELD CITY UTILITIES
UNIT NAME		SOUTHWEST 1
UNIT LOCATION		SPRINGFIELD MISSOURI
UNIT RATING		200 MW
FUEL CHARACTERISTICS		COAL 3.5 PERCENT SULFUR
FGD VENDOR		AIR CORRECTION DIVISION, UOP
PROCESS		LIMESTONE
NEW OR RETROFIT		NEW
START UP DATE		4/77
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99.8 PERCENT
	(DESIGN)	99.7 PERCENT
SO2	(ACTUAL)	92.0 PERCENT
	(DESIGN)	80.0 PERCENT
WATER MAKE UP		
SLUDGE DISPOSAL		FILTER CAKE LANDFILL

OPERATING EXPERIENCE UPDATE:

FEB. 78
MAR. 78

THE ABSORBERS DID NOT OPERATE DUE TO AN EXPANSION JOINT FAILURE BETWEEN THE ID FAN AND THE ABSORBERS. CURRENTLY, THE ABSORBERS ARE BEING BY-PASSED. THE FGD SYSTEM IS EXPECTED TO BE BACK ON LINE BY THE END OF APRIL.

APR. 78
MAY 78

THE UNIT EXPERIENCED AN FRP LINER FAILURE AS WELL AS A PUMP FAILURE DURING THE PERIOD. CURRENTLY ONLY ONE SCRUBBER-ABSORBER MODULE IS RUNNING. THE EXPANSION JOINT FAILURE MENTIONED PREVIOUSLY WAS DIRECTLY RELATED TO THE DAMPER FAILURE WHICH ALLOWED THE BOILER TO CONTINUE PUMPING GAS TO THE SEALED OFF FGD SYSTEM.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		TENNESSEE VALLEY AUTHORITY
UNIT NAME		SHAWNEE 10A
UNIT LOCATION		PADUCAH KENTUCKY
UNIT RATING		10 MW
FUEL CHARACTERISTICS		COAL 2.9 PERCENT SULFUR
FGD VENDOR		AIR CORRECTION DIVISION, UOP
PROCESS		LIME/LIMESTONE
NEW OR RETROFIT		RETROFIT
START UP DATE		4/72
EFFICIENCY:		
PARTICULATES	(ACTUAL)	
	(DESIGN)	EXPERIMENTALLY CONTROLLED
SO2	(ACTUAL)	
	(DESIGN)	EXPERIMENTALLY CONTROLLED
WATER MAKE UP		EXPERIMENTALLY CONTROLLED
SLUDGE DISPOSAL		EXPERIMENTALLY CONTROLLED

OPERATING EXPERIENCE UPDATE:

REFER TO OPERATING EXPERIENCE UPDATE FOR SHAWNEE NO. 10B.

SECTION 5
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		TENNESSEE VALLEY AUTHORITY
UNIT NAME		SHAWNEE 10B
UNIT LOCATION		PADUCAH KENTUCKY
UNIT RATING		10 MW
FUEL CHARACTERISTICS		COAL 2.9 PERCENT SULFUR
FGD VENDOR		CHEMICO
PROCESS		LIME/LIMESTONE
NEW OR RETROFIT		RETROFIT
START UP DATE		4/72
EFFICIENCY:		
PARTICULATES	(ACTUAL)	
	(DESIGN)	EXPERIMENTALLY CONTROLLED
SO2	(ACTUAL)	
	(DESIGN)	EXPERIMENTALLY CONTROLLED
WATER MAKE UP		EXPERIMENTALLY CONTROLLED
SLUDGE DISPOSAL		EXPERIMENTALLY CONTROLLED

OPERATING EXPERIENCE UPDATE:

FEB. 78
MAR. 78

MAJOR SYSTEM DOWNTIMES DURING THE PERIOD INCLUDED: JANUARY 26 THROUGH FEBRUARY 4 FOR THE VENTURI/SPRAY TOWER AND JANUARY 26 THROUGH FEBRUARY 2 FOR THE TCA SYSTEM DUE TO FREEZING WEATHER, AND MARCH 6 THROUGH MARCH 17 FOR BOTH SYSTEMS DUE TO BOILER OUTAGE.

THE EFFECT OF THE SLURRY LEVEL IN THE AIR SPARGED OXIDATION TANK WAS INVESTIGATED IN THE TWO SCRUBBER LOOP VENTURI/SPRAY TOWER SYSTEM WHICH IS OPERATING ON LIME SLURRY WITH HIGH FLY ASH LOADING. NEAR COMPLETE SULFITE OXIDATION (98 PERCENT) WAS ACHIEVED WITH 14 FOOT AND 18 FOOT OXIDATION TANK LEVELS AT AN AIR STOICHIOMETRIC RATIO OF 1.8 ATOMS OXYGEN/MOLE SO2 ABSORBED. AN AIR STOICHIOMETRIC RATIO UP TO ABOUT 3.8 WAS NEEDED TO YIELD NEAR COMPLETE OXIDATION WHEN THE TANK LEVEL WAS DROPPED TO 10 FEET.

A NEW TEST BLOCK WAS STARTED ON MARCH 1 ON THE VENTURI/SPRAY TOWER SYSTEM. MAGNESIUM OXIDE WAS ADDED TO THE SPRAY TOWER SLURRY LOOP IN A TWO SCRUBBER LOOP OPERATION WITH FORCED OXIDATION IN THE VENTURI LOOP. THE SYSTEM WAS OPERATED IN A LIMESTONE SLURRY MODE WITH HIGH FLY ASH LOADING. THE PRIMARY OBJECTIVE OF MAGNESIUM ADDITION IS TO IMPROVE THE SO2 REMOVAL EFFICIENCY. BECAUSE OF THE SHORTAGE OF COAL CAUSED BY THE COAL MINERS' STRIKE, COALS FROM DIFFERENT SOURCES WERE BURNED IN THE BOILER. AS A RESULT, INLET SO2 CONCENTRATION FLUCTUATED AS MUCH AS TENFOLD (350-3500 PPM), CAUSING PROBLEMS IN SYSTEM CONTROL.

TCA WAS OPERATED WITH BOTH LIME AND LIMESTONE, AND WITH MAGNESIUM OXIDE ADDITION. FLUE GAS WITH HIGH FLY ASH LOADING WAS USED. THESE TESTS WERE CONDUCTED PRIMARILY TO RESOLVE SOME OF THE INCONSISTENT RESULTS OBTAINED DURING EARLIER LIME/MGO AND LIMESTONE/MGO TESTS MADE IN APRIL-NOVEMBER 1976. AIR LEAKAGE THROUGH THE SCRUBBER DOWNCOMER WAS SUSPECTED IN SOME OF THOSE EARLIER RUNS, RESULTING IN HIGHER-THAN-NORMAL SULFITE OXIDATION AND GYPSUM SATURATION. TEST RESULTS SO FAR WERE INCONCLUSIVE BECAUSE OF THE FLUCTUATION IN INLET SO2 AND CONTROL PROBLEMS MENTIONED ABOVE.

APR. 78
MAY 78

THE VENTURI/SPRAY TOWER SYSTEM CONTINUED TO OPERATE THROUGH EARLY MAY WITH MGO ADDITION AND WITH TWO SCRUBBER LOOPS. THE SYSTEM WAS OPERATED WITH LIMESTONE SLURRY AND WITH HIGH FLY ASH LOADING. MGO WAS ADDED TO THE SPRAY TOWER SLURRY LOOP TO MAINTAIN AN EFFECTIVE MG++ ION CONCENTRATION OF 5000 PPM (ABOUT 8000 PPM IN THE VENTURI SLURRY LOOP) TO IMPROVE THE SO2 REMOVAL EFFICIENCY IN THE SPRAY TOWER. OXIDATION WAS FORCED IN THE VENTURI SLURRY HOLD TANK. UNDER TYPICAL OPERATING CONDITIONS, THE OVERALL SO2 REMOVAL WAS 96 PERCENT AT 2300 PPM INLET SO2 CONCENTRATION, COMPARED TO 86 PERCENT REMOVAL AT 1600 PPM INLET SO2 WITHOUT MGO ADDITION. SO2 REMOVAL BY VENTURI ALONE WAS 30 PERCENT, ABOUT THE SAME AS THE CASE WITHOUT MGO ADDITION. NEAR COMPLETE SULFITE OXIDATION COULD BE ACHIEVED AT AN AIR STOICHIOMETRIC RATIO AS LOW AS 1.3 ATOMS OXYGEN/MOLE SO2 ABSORBED, IN THE SAME ORDER AS THE CASE WITHOUT MGO ADDITION.

FORCED OXIDATION WAS ALSO CONDUCTED ON THE LIMESTONE SLURRY BLEED STREAM FROM THE VENTURI/SPRAY TOWER SYSTEM. A SINGLE EFFLUENT HOLD TANK WAS USED FOR BOTH VENTURI AND SPRAY TOWER. MGO WAS ADDED TO THE EFFLUENT HOLD TANK TO MAINTAIN AN EFFECTIVE MG++ ION CONCEN-

TRATION OF 5000 PPM. A SLURRY STREAM WAS TAKEN FROM THE SCRUBBER DOWNCOMER AND SENT TO AN OXIDATION TANK INTO WHICH AIR WAS SPARGED. A RECYCLE STREAM OF ABOUT 30 GPM WAS SENT BACK FROM THE OXIDATION TANK TO THE EFFLUENT HOLD TANK TO CONTROL PH IN THE OXIDATION TANK AND TO PROVIDE GYPSUM SEEDS IN THE SCRUBBER SLURRY. FINAL SYSTEM BLEED WAS WITHDRAWN FROM THE OXIDATION TANK. AT AN AVERAGE OXIDATION TANK PH OF 6, SULFITE OXIDATION AVERAGED 98 PERCENT. FILTER CAKE SOLIDS CONTENT WAS 85 PERCENT, SIMILAR TO THAT OBTAINED WITH TWO SCRUBBER LOOP OPERATIONS. HOWEVER, THE SLURRY SOLIDS SETTLING RATE WAS ONLY ABOUT 0.4 CM/MIN, COMPARED TO ABOUT 0.8 CM/MIN FOR THE TWO LOOP OPERATION. SETTLING RATE FOR UNOXIDIZED SLURRY CONTAINING MAGNESIUM ION NORMALLY DID NOT EXCEED 0.1 CM/MIN WITH 50 TO 60 PERCENT FILTER CAKE SOLIDS.

TCA CONTINUED TO OPERATE WITH MGO ADDITION WITH BOTH LIME AND LIMESTONE SCRUBBING. FLUE GAS WITH HIGH FLY ASH LOADING WAS USED. THE INTENT OF THESE TESTS WAS TO CLARIFY SOME OF THE INCONSISTENT RESULTS OBTAINED DURING EARLIER RUNS MADE IN APRIL-NOVEMBER 1976, DURING WHICH SCRUBBER DOWNCOMER AIR LEAKAGE WAS SUSPECTED IN SOME OF THE TESTS. IN GENERAL, TESTS RUNS MADE IN 1976 HAD HIGHER INLET SO2 CONCENTRATION, MOSTLY GREATER THAN 3000 PPM, WHILE THE RECENT RUNS HAD ONLY ABOUT 2500 PPM. AT THE HIGHER INLET SO2 AND THE HIGHER RESULTANT SO2 MAKE-PER-PASS, THE 1976 TESTS OPERATED EITHER UNSATURATED OR SUPERSATURATED WITH RESPECT TO GYPSUM, DEPENDING ON THE SULFITE OXIDATION LEVEL. SEVERE GYPSUM SCALING OCCURRED WHEN THE OPERATION WAS UNDER GYPSUM-SATURATED MODE. IN THE RECENT RUNS, OPERATION WAS MOSTLY UNDER GYPSUM-SATURATED MODE. HOWEVER, BECAUSE OF THE LOWER INLET SO2 AND LOWER SO2 MAKE-PER-PASS, THE GYPSUM SATURATION LEVELS WERE NOT HIGH ENOUGH TO CAUSE ANY SIGNIFICANT SCALING.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		TENNESSEE VALLEY AUTHORITY
UNIT NAME		WIDOWS CREEK 8
UNIT LOCATION		BRIDGEPORT ALABAMA
UNIT RATING		550 MW
FUEL CHARACTERISTICS		COAL 3.7 PERCENT SULFUR
FGD VENDOR		TENNESSEE VALLEY AUTHORITY
PROCESS		LIMESTONE
NEW OR RETROFIT		RETROFIT
START UP DATE		5/77
EFFICIENCY:		
PARTICULATES	(ACTUAL)	99.5+ PERCENT
	(DESIGN)	99.5 PERCENT
SO2	(ACTUAL)	85-94 PERCENT
	(DESIGN)	80.0 PERCENT
WATER MAKE UP		
SLUDGE DISPOSAL		100-ACRE DIKED POND

OPERATING EXPERIENCE UPDATE:

MONTH	BOILER	OPERATING HOURS A-SIDE	B-SIDE	C-SIDE	D-SIDE	COMMENTS
FEB. 78 AVAILABILITY = 55% OPERABILITY = 54% RELIABILITY = 61% * UTILIZATION = 47%	586	171	401	370	314	THE OUTAGE TIME FOR TRAINS A AND B WAS REQUIRED TO REPLACE THE RUBBER LINERS IN THE DOWNCOMER AREA WITH STAINLESS STEEL. THIS WILL BE DONE TO THE REMAINING TWO TRAINS AS WELL.

* THE UTILITY REPORTED THAT THEY COULD NOT ACCURATELY DETERMINE RELIABILITY BECAUSE OF THEIR INABILITY TO CALCULATE UNIT LOAD DEMAND ON A DAILY BASIS. GENERALLY, IT IS ASSUMMED THAT SYSTEM FORCED OUTAGE HOURS PLUS THE HOURS FGD SYSTEM OPERATED WILL GIVE ROUGHLY THE HOURS THE SYSTEM WAS CALLED UPON TO OPERATE. IN THIS WAY, RELIABILITY CAN BE CALCULATED INDIRECTLY. HOWEVER, IN THIS CASE, TWO TRAINS AT A TIME HAVE BEEN DOWN ON A SCHEDULED OUTAGE FOR NECESSARY MODIFICATIONS. PART OF THIS OUTAGE TIME LIMITED BOILER OPERATION SO THAT THE UNIT COULD NOT RUN AT FULL LOAD WHEN THERE WAS A DEMAND FOR FULL LOAD. FOR THIS CALCULATION IT WAS ASSUMMED THAT THERE WAS A DEMAND FOR FULL LOAD DURING THE ENTIRE SCHEDULED OUTAGE SO THAT ALL OF THE TRAINS WOULD HAVE BEEN CALLED THE ENTIRE SCHEDULED OUTAGE. THE RESULT WAS A VERY CONSERVATIVE ESTIMATE OF RELIABILITY WHERE HOURS CALLED = SYSTEM FORCED OUTAGE HOURS + SYSTEM SCHEDULED OUTAGE + HOURS THE FGD SYSTEM OPERATED.

NOTE: THIS IS A PEDCO ESTIMATE.

MONTH	BOILER	A-SIDE	B-SIDE	C-SIDE	D-SIDE	COMMENTS
MAR. 78 AVAILABILITY = 60% OPERABILITY = 66% RELIABILITY = 59% * UTILIZATION = 58%	644	585	344	199	583	TRAIN B WAS OUT OF SERVICE MARCH 1 - MARCH 13 TO INSTALL STAINLESS STEEL IN THE ABSORBER AND VENTURI DOWNCOMER AREAS. STAINLESS STEEL COVERS WERE INSTALLED AROUND TWO EXPANSION JOINTS ON TRAIN C, IN ORDER TO PREVENT FLUE GAS LEAKAGE FROM THE EXPANSION JOINTS. A STAINLESS STEEL PLATE WAS WELDED OVER THE ENTRY DOOR OPENINGS TO TRAIN C OUTLET AND BYPASS GUILLOTINE DAMPERS FOR THE PURPOSE OF ELIMINATING GAS LEAKAGE. TRAIN C WAS OUT OF SERVICE MARCH 14 - MARCH 29 TO INSTALL STAINLESS STEEL IN THE ABSORBER AND VENTURI DOWNCOMER AREAS. SEVERAL LIFTER BARS ON THE FEED AND DISCHARGE ENDS OF THE BALL MILL WERE FOUND TO BE BADLY WORN. THE UTILITY HAS HAD WEAR PROBLEMS WITH THE SLURRY SUMP PUMP LINERS AT THE BALL MILL.

EPA UTILITY FGD SURVEY: APRIL 1978 - MAY 1978

MONTH	BOILER	A-SIDE	B-SIDE	C-SIDE	D-SIDE	COMMENTS
APR. 78 AVAILABILITY = 69% OPERABILITY = 83% RELIABILITY = 67% * UTILAZATION = 62%	540	480	464	576	275	AT THE BEGINNING OF THIS MONTH, DURING A BRIEF INSPECTION OF THE SCRUBBER, SOLIDS DEPOSITION WAS NOTICED IN THE ENTRAINMENT SEPARATOR SECTION OF ALL TRAINS BECAUSE OF PLUGGING THAT HAD OCCURRED IN SEVERAL OF THE ENTRAINMENT SEPARATOR SPRAY NOZZLES. TRAIN D WAS NOT IN OPERATION FOR 17 DAYS. DURING THIS PERIOD THE ENTRAINMENT SEPERATOR WAS DISSASSEMBLED BY SECTIONS AND CLEANED. A STAINLESS STEEL LINER WAS INSTALLED ON THE SLOPING AREAS OF THE ABSORBER AND VENTURI. STAINLESS STEEL PLATES WERE INSTALLED OVER THE ENTRY DOOR OPENINGS TO TRAIN D INLET, OUTLET, AND BYPASS GUILLOTINE DAMPERS TO REDUCE GAS LEAKAGE FROM THE ENTRY DOOR OPENINGS. STAINLESS STEEL COVERS WERE INSTALLED AROUND THE FIVE EXPANSION JOINTS ON TRAIN D, TWO EXPANSION JOINTS ON TRAIN A, AND ONE EXPANSION JOINT ON TRAIN B, TO REDUCE GAS LEAKAGE TO THE ATMOSPHERE. THERE CONTINUES TO BE A WEAR PROBLEM WITH PUMP LINERS AT THE BALL MILL. NO CAUSE OR SOLUTION OF THE PROBLEM HAS BEEN ASCERTAINED AS YET.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		TEXAS UTILITIES
UNIT NAME		MARTIN LAKE 1
UNIT LOCATION		TATUM TEXAS
UNIT RATING		793 MW
FUEL CHARACTERISTICS		COAL 1.0 PERCENT SULFUR
FGD VENDOR		RESEARCH COTTRELL
PROCESS		LIMESTONE
NEW OR RETROFIT		NEW
START UP DATE		8/77
EFFICIENCY:		
PARTICULATES	(ACTUAL)	
	(DESIGN)	99.4 PERCENT
SO2	(ACTUAL)	
	(DESIGN)	70.5
WATER MAKE UP		
SLUDGE DISPOSAL		STABILIZED/ON-SITE DISPOSAL

OPERATING EXPERIENCE UPDATE:

FEBRUARY-MARCH 1978 - CERTIFICATION WAS RECEIVED FROM THE EPA FOR THIS UNIT. THE BOILER AND SCRUBBER-ABSORBER SYSTEM OPERATED THROUGHOUT THE PERIOD. THE UTILITY IS STILL HAVING SOME PROBLEMS WITH THE SLURRY HANDLING SYSTEM, AND SOME FORCED OUTAGE TIME OCCURRED.

APRIL-MAY 1978 - NO INFORMATION WAS REPORTED BY THE UTILITY FOR THIS PERIOD.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		TEXAS UTILITIES
UNIT NAME		MONTICELLO 3
UNIT LOCATION		MT. PLEASANT TEXAS
UNIT RATING		750 MW
FUEL CHARACTERISTICS		LIGNITE 1.5 PERCENT SULFUR
FGD VENDOR		CHEMICO
PROCESS		LIMESTONE
NEW OR RETROFIT		NEW
START UP DATE		5/78
EFFICIENCY:		
PARTICULATES	(ACTUAL)	
	(DESIGN)	99.5 PERCENT
SO2	(ACTUAL)	
	(DESIGN)	74.0 PERCENT
WATER MAKE UP		CLOSED LOOP
SLUDGE DISPOSAL		STABILIZED/ON-SITE DISPOSAL

OPERATING EXPERIENCE UPDATE:

APR. 78 MAY 78	THE TEXAS AIR CONTROL BOARD REPORTED THAT THE TEXAS UTILITIES 750 MW MONTICELLO UNIT 3 BEGAN FGD OPERATIONS DURING THE REPORT PERIOD. AS OF YET THE UNIT HAS NOT RUN AT FULL LOAD BUT IS EXPECTED TO BY THE END OF AUGUST.

SECTION 3
PERFORMANCE DESCRIPTION FOR OPERATIONAL FGD SYSTEMS

UTILITY NAME		UTAH POWER & LIGHT
UNIT NAME		HUNTINGTON 1
UNIT LOCATION		PRICE UTAH
UNIT RATING		415 MW
FUEL CHARACTERISTICS		COAL 0.5 PERCENT SULFUR
FGD VENDOR		CHEMICO
PROCESS		LIME
NEW OR RETROFIT		NEW
START UP DATE		5/78
EFFICIENCY:		
PARTICULATES	(ACTUAL)	
	(DESIGN)	99.5 PERCENT
SO2	(ACTUAL)	
	(DESIGN)	80.0 PERCENT
WATER MAKE UP		CLOSED LOOP
SLUDGE DISPOSAL		

OPERATING EXPERIENCE UPDATE:

APRIL-MAY 1978 - INITIAL OPERATIONS BEGAN MAY 10 AT THIS PLANT. COMMERCIAL START-UP IS EXPECTED SOMETIME IN JULY.

SECTION 4
SUMMARY OF FGD SYSTEMS BY COMPANY

UTILITY	TOTAL NO	TOTAL MW	STATUS: OPERATIONAL NO	OPERATIONAL MW	CONSTRUCTION NO	CONSTRUCTION MW	CONTRACT AWARDED NO	CONTRACT AWARDED MW	PLANNED NO	PLANNED MW
ALABAMA ELECTRIC COOP	2	450.	0	0.	2	450.	0	0.	0	0.
ALLEGHENY POWER SYSTEM	2	1250.	0	0.	2	1250.	0	0.	0	0.
ARIZONA ELECTRIC POWER COOP	2	400.	0	0.	2	400.	0	0.	0	0.
ARIZONA PUBLIC SERVICE	8	2804.	2	365.	0	0.	1	350.	5	2089.
ASSOCIATED ELECTRIC COOP	1	670.	0	0.	0	0.	1	670.	0	0.
BASIN ELECTRIC POWER COOP	5	2600.	0	0.	2	1140.	0	0.	3	1460.
BIG RIVERS ELECTRIC	2	490.	0	0.	2	490.	0	0.	0	0.
BRAZOS ELECTRIC POWER COOP	1	400.	0	0.	1	400.	0	0.	0	0.
CENTRAL ILLINOIS LIGHT	2	800.	0	0.	1	400.	0	0.	1	400.
CENTRAL ILLINOIS PUBLIC SERV	1	575.	0	0.	1	575.	0	0.	0	0.
CENTRAL MAINE POWER	1	600.	0	0.	0	0.	0	0.	1	600.
CINCINNATI GAS & ELECTRIC	1	600.	0	0.	0	0.	1	600.	0	0.
COLORADO UTE ELECTRIC ASSN.	2	900.	0	0.	2	900.	0	0.	0	0.
COLUMBUS & SOUTHERN OHIO ELEC.	4	1550.	2	800.	0	0.	0	0.	2	750.
COMMONWEALTH EDISON	1	425.	0	0.	1	425.	0	0.	0	0.
COOPERATIVE POWER ASSOCIATION	2	1090.	0	0.	2	1090.	0	0.	0	0.
DELMARVA POWER & LIGHT	1	180.	0	0.	1	180.	0	0.	0	0.
DUQUESNE LIGHT	2	920.	2	920.	0	0.	0	0.	0	0.
EASTERN KENTUCKY POWER COOP	1	500.	0	0.	0	0.	1	500.	0	0.
GENERAL PUBLIC UTILITIES	2	1600.	0	0.	0	0.	0	0.	2	1600.
GULF POWER	1	20.	0	0.	1	20.	0	0.	0	0.
HOOSIER ENERGY	2	980.	0	0.	2	980.	0	0.	0	0.
INDIANAPOLIS POWER & LIGHT	2	1060.	1	530.	1	530.	0	0.	0	0.
KANSAS CITY POWER & LIGHT	3	1060.	3	1060.	0	0.	0	0.	0	0.
KANSAS POWER & LIGHT	4	1885.	2	525.	2	1360.	0	0.	0	0.
KENTUCKY UTILITIES	1	64.	1	64.	0	0.	0	0.	0	0.
LAKELAND UTILITIES	1	350.	0	0.	0	0.	1	350.	0	0.
LOUISVILLE GAS & ELECTRIC	8	2283.	3	426.	3	1197.	0	0.	2	660.
MINNESOTA POWER & LIGHT	1	500.	0	0.	1	500.	0	0.	0	0.
MINNKOTA POWER COOPERATIVE	1	450.	1	450.	0	0.	0	0.	0	0.
MONTANA POWER	4	2120.	2	720.	0	0.	2	1400.	0	0.
NEVADA POWER	10	3000.	3	375.	0	0.	0	0.	7	2625.
NEW ENGLAND ELEC SYSTEM	1	650.	0	0.	0	0.	0	0.	1	650.
NIAGARA MOHAWK POWER COOP	1	100.	0	0.	0	0.	1	100.	0	0.
NORTHERN INDIANA PUB SERVICE	3	705.	1	115.	0	0.	0	0.	2	590.
NORTHERN STATES POWER	4	3140.	2	1420.	0	0.	2	1720.	0	0.
OTTER TAIL POWER	1	400.	0	0.	0	0.	1	400.	0	0.
PACIFIC GAS AND ELECTRIC	2	1600.	0	0.	0	0.	0	0.	2	1600.
PACIFIC POWER & LIGHT	1	509.	0	0.	1	509.	0	0.	0	0.
PENNSYLVANIA POWER	3	2475.	2	1650.	0	0.	1	825.	0	0.
PHILADELPHIA ELECTRIC	4	840.	1	120.	0	0.	0	0.	3	720.
PUBLIC SERVICE OF INDIANA	1	650.	0	0.	0	0.	0	0.	1	650.
PUBLIC SERVICE OF NEW MEXICO	4	1560.	1	316.	1	300.	1	468.	1	472.
SALT RIVER PROJECT	3	1050.	0	0.	2	700.	0	0.	1	350.
SIKESTON BOARD OF MUNIC. UTIL.	1	235.	0	0.	1	235.	0	0.	0	0.
SOUTH CAROLINA PUBLIC SERVICE	2	500.	1	200.	1	300.	0	0.	0	0.
SOUTHERN ILLINOIS POWER COOP	2	484.	0	0.	1	184.	0	0.	1	300.
SOUTHERN INDIANA GAS & ELEC	1	250.	0	0.	1	250.	0	0.	0	0.
SOUTHERN MISSISSIPPI ELECTRIC	2	360.	0	0.	2	360.	0	0.	0	0.
SOUTHWESTERN ELECTRIC POWER	1	720.	0	0.	0	0.	1	720.	0	0.
SPRINGFIELD CITY UTILITIES	1	200.	1	200.	0	0.	0	0.	0	0.
SPRINGFIELD WATER LIGHT & PWR	1	190.	0	0.	0	0.	1	190.	0	0.
ST. JOE MINERALS CORP.	1	60.	0	0.	1	60.	0	0.	0	0.
TENNESSEE VALLEY AUTHORITY	4	1145.	3	570.	0	0.	1	575.	0	0.
TEXAS MUNICIPAL POWER AGENCY	1	400.	0	0.	0	0.	1	400.	0	0.
TEXAS POWER & LIGHT	3	2065.	0	0.	0	0.	1	565.	2	1500.
TEXAS UTILITIES	6	4672.	2	1563.	2	1566.	1	793.	1	750.
UTAH POWER & LIGHT	2	815.	1	415.	1	400.	0	0.	0	0.
WISCONSIN POWER & LIGHT	1	527.	0	0.	0	0.	0	0.	1	527.
TOTALS	130	50944.	37	12862.	43	17177.	19	10606.	30	10299.

NOTE - PLANNED STATUS INCLUDES LETTER OF INTENT SIGNED, REQUESTING/EVALUATING BIDS, AND CONSIDERING ONLY FGD SYSTEMS

SECTION 5
SUMMARY OF FGD SYSTEMS BY VENDOR

MANUFACTURER/PROCESS	TOTAL NO.	TOTAL MW	OPERATIONAL NO.	OPERATIONAL MW	CONSTRUCTION NO.	CONSTRUCTION MW	CONTRACT AWARDED NO.	CONTRACT AWARDED MW
ADL/COMBUSTION EQUIP ASSOCIATE								
DOUBLE ALKALI	1	277.	0	0.	1	277.	0	0.
LIME/ALKALINE FLYASH	5	2570.	3	1170.	0	0.	2	1400.
SODIUM CARBONATE	3	375.	3	375.	0	0.	0	0.
TOTAL =	9	3222.	6	1545.	1	277.	2	1400.
AIR CORRECTION DIVISION, UOP								
LIME	2	800.	2	800.	0	0.	0	0.
LIME/LIMESTONE	1	10.	1	10.	0	0.	0	0.
LIMESTONE	2	920.	1	200.	0	0.	1	720.
SODIUM CARBONATE	1	509.	0	0.	1	509.	0	0.
TOTAL =	6	2239.	4	1010.	1	509.	1	720.
AIR CORRECTION DIVISON, UOP								
LIMESTONE	1	425.	0	0.	1	425.	0	0.
TOTAL =	1	425.	0	0.	1	425.	0	0.
AMERICAN AIR FILTER								
LIME	6	1652.	2	242.	4	1410.	0	0.
TOTAL =	6	1652.	2	242.	4	1410.	0	0.
ATOMICS INTERNATIONAL								
AQUEOUS CARBONATE	1	100.	0	0.	0	0.	1	100.
TOTAL =	1	100.	0	0.	0	0.	1	100.
BABCOCK & WILCOX								
LIME	3	1850.	0	0.	2	1250.	1	600.
LIMESTONE	7	2560.	2	1100.	4	1110.	1	350.
TOTAL =	10	4410.	2	1100.	6	2360.	2	950.
BUELL/ENVIROTECH								
DOUBLE ALKALI	1	575.	0	0.	1	575.	0	0.
TOTAL =	1	575.	0	0.	1	575.	0	0.
BUREAU OF MINES								
CITRATE	1	60.	0	0.	1	60.	0	0.
TOTAL =	1	60.	0	0.	1	60.	0	0.
CHEMICO								
LIME	6	3285.	5	2665.	1	620.	0	0.
LIME/LIMESTONE	1	20.	1	20.	0	0.	0	0.
LIMESTONE	1	750.	1	750.	0	0.	0	0.
TOTAL =	8	4055.	7	3435.	1	620.	0	0.
CHIYODA INTERNATIONAL								
LIMESTONE	1	23.	0	0.	1	23.	0	0.
TOTAL =	1	23.	0	0.	1	23.	0	0.
COMBUSTION ENGINEERING								
LIME	7	2470.	4	860.	2	1050.	1	560.
LIMESTONE	7	3075.	2	525.	2	1050.	3	1500.
LIMESTONE/ALKALINE FLY ASH	3	2450.	1	710.	0	0.	2	1740.
LIMESTONE/ALKALINE FLYASH	1	710.	1	710.	0	0.	0	0.
TOTAL =	18	8705.	8	2805.	4	2100.	6	3800.
DAVY POWERGAS								
WELLMAN LORD	2	1000.	0	0.	1	350.	1	650.
TOTAL =	2	1000.	0	0.	1	350.	1	650.
DAVY POWERGAS/ALLIED CHEMICAL								
WELLMAN LORD	2	480.	1	180.	1	300.	0	0.
WELLMAN LORD/ALLIED CHEMICAL	1	115.	1	115.	0	0.	0	0.
TOTAL =	3	595.	2	295.	1	300.	0	0.

EPA UTILITY FGD SURVEY: APRIL 1978 - MAY 1978

SECTION 5
SUMMARY OF FGD SYSTEMS BY VENDOR

			STATUS					
	TOTAL		OPERATIONAL		CONSTRUCTION		CONTRACT AWARDED	
MANUFACTURER/PROCESS	NO.	MW	NO.	MW	NO.	MW	NO.	MW
FMC CORPORATION								
DOUBLE ALKALI	1	250.	0	0.	1	250.	0	0.
TOTAL =	1	250.	0	0.	1	250.	0	0.
MITSUBISHI								
LIMESTONE	1	490.	0	0.	1	490.	0	0.
TOTAL =	1	490.	0	0.	1	490.	0	0.
MITSUBISHI INTERNATIONAL								
LIMESTONE	1	490.	0	0.	1	490.	0	0.
TOTAL =	1	490.	0	0.	1	490.	0	0.
PEABODY ENGINEERING								
LIME/ALKALINE FLYASH	1	500.	0	0.	1	500.	0	0.
LIMESTONE	4	1350.	0	0.	4	1350.	0	0.
TOTAL =	5	1850.	0	0.	5	1850.	0	0.
PULLMAN KELLOGG								
LIME	1	825.	0	0.	0	0.	1	825.
LIMESTONE	3	1370.	0	0.	2	700.	1	670.
TOTAL =	4	2195.	0	0.	2	700.	2	1495.
RESEARCH COTTRELL								
LIMESTONE	13	6147.	3	1158.	7	3656.	3	1333.
TOTAL =	13	6147.	3	1158.	7	3656.	3	1333.
RILEY STOKER / ENVIRONEERING								
LIMESTONE	3	700.	0	0.	3	700.	0	0.
TOTAL =	3	700.	0	0.	3	700.	0	0.
TENNESSEE VALLEY AUTHORITY								
LIMESTONE	1	550.	1	550.	0	0.	0	0.
TOTAL =	1	550.	1	550.	0	0.	0	0.
UNITED ENGINEERS / PECO								
MAGNESIUM OXIDE	1	120.	1	120.	0	0.	0	0.
TOTAL =	1	120.	1	120.	0	0.	0	0.
UNIVERSAL OIL PRODUCTS								
LIMESTONE	1	[illegible]	1	[illegible]	0	0.	0	0.
TOTAL =	1	[illegible]	1	[illegible]	0	0.	0	0.
WHEELABRATOR-FRYE/R.I.								
AQUEOUS CARBONATE	1	[illegible]	0	0.	0	0.	1	[illegible]
TOTAL =	1	[illegible]	0	0.	0	0.	1	[illegible]
	98	[illegible]	37	[illegible]	42	[illegible]	19	[illegible]

SECTION 6
SUMMARY OF NEW AND RETROFIT FGD SYSTEMS BY PROCESS

PROCESS	NEW OR RETROFIT	OPERATIONAL NO.	OPERATIONAL MW	CONSTRUCTION NO.	CONSTRUCTION MW	CONTRACT AWARDED NO.	CONTRACT AWARDED MW	PLANNED NO.	PLANNED MW	TOTAL NO. OF PLANTS NO.	TOTAL NO. OF PLANTS MW
LIME	N	5	2865	9	4150	3	1925	1	455	18	9395
	R	8	1650	0	0	0	0	2	660	10	2310
LIME/ALKALINE FLYASH	N	3	1170	1	500	2	1400	1	527	7	3597
	R	0	0	0	0	0	0	3	579	3	579
LIME/LIMESTONE	N	0	0	0	0	0	0	0	0	0	0
	R	2	20	0	0	0	0	0	0	2	20
LIMESTONE	N	8	4023	24	9425	8	4018	6	3850	46	21316
	R	3	790	2	445	1	575	0	0	6	1810
LIMESTONE/ALKALINE FLY ASH	N	1	710	0	0	2	1720	0	0	3	2430
	R	0	0	0	0	0	0	0	0	0	0
LIMESTONE/ALKALINE FLYASH	N	1	710	0	0	0	0	0	0	1	710
	R	0	0	0	0	0	0	0	0	0	0
		-----	------	-----	------	-----	------	-----	------	-----	------
SUBTOTAL - LIME/LIMESTONE	N	18.	9478.	34.	14075.	15.	9063.	8.	4832.	75.	37448.
	R	13.	2460.	2.	445.	1.	575.	5.	1239.	21.	4719.
AQUEOUS CARBONATE	N	0	0	0	0	1	400	0	0	1	400
	R	0	0	0	0	1	100	0	0	1	100
CITRATE	N	0	0	0	0	0	0	0	0	0	0
	R	0	0	1	60	0	0	0	0	1	60
DOUBLE ALKALI	N	0	0	2	625	0	0	0	0	2	625
	R	0	0	1	277	0	0	0	0	1	277
MAGNESIUM OXIDE	N	0	0	0	0	0	0	0	0	0	0
	R	1	120	0	0	0	0	3	720	4	840
NOT SELECTED	N	0	0	0	0	0	0	16	8155	16	8155
	R	0	0	0	0	0	0	5	2750	5	2750
SODIUM CARBONATE	N	1	125	1	500	0	0	1	125	3	750
	R	2	250	0	0	0	0	0	0	2	250
WELLMAN LORD	N	1	310	0	0	1	[illegible]	1	[illegible]	3	[illegible]
	R	0	0	2	490	0	0	0	0	2	490
WELLMAN LORD/ALLIED CHEMICAL	N	0	0	0	0	0	0	0	0	0	0
	R	1	115	0	0	0	0	0	0	1	115
		-----	------	-----	------	-----	------	-----	------	-----	------
TOTALS	N	20.	9913.	37.	15200.	17.	[illegible]	26.	[illegible]	100.	[illegible]
	R	17.	2945.	6.	1272.	2.	675.	13.	4709.	38.	9601.
LIME/LIMESTONE % OF TOTAL MW	N	96		93		[illegible]		[illegible]		77	
	R	84		35		85		26		49	

SECTION 7
SUMMARY OF OPERATING FGD SYSTEMS BY PROCESS AND GENERATING UNITS

PROCESS/GENERATING UNITS	FGD/MW	STARTUP	EXPERIENCE(MO.)
LIME			
BRUCE MANSFIELD 1	825	4-76	25
BRUCE MANSFIELD 2	825	7-77	10
CANE RUN 4	178	8-76	21
CANE RUN 5	183	12-77	5
CONESVILLE 5	400	1-77	16
CONESVILLE 6	400	4-78	1
ELRAMA POWER STATION	510	10-75	31
GREEN RIVER 1,2 & 3	64	9-75	32
HAWTHORN 3	140	11-72	66
HAWTHORN 4	100	8-72	69
HUNTINGTON 1	415	5-78	0
PADDYS RUN 6	65	4-73	61
PHILLIPS POWER STATION	410	7-73	58
	------		----
	4515.		395
LIME/ALKALINE FLYASH			
COLSTRIP 1	360	11-75	30
COLSTRIP 2	360	07-60	134
MILTON R. YOUNG 2	450	9-77	8
	------		----
	1170.		172
LIME/LIMESTONE			
SHAWNEE 10A	10	4-72	73
SHAWNEE 10B	10	4-72	73
	------		----
	20.		146
LIMESTONE			
CHOLLA 1	115	10-73	55
CHOLLA 2	250	4-78	0
LA CYGNE 1	820	2-73	63
LAWRENCE 4	125	12-68	113
LAWRENCE 5	420	11-71	78
MARTIN LAKE	793	8-77	9
MONTICELLO 3	750	5-78	0
PETERSBURG 3	530	10-77	7
SOUTHWEST 1	200	4-77	13
WIDOWS CREEK 8	550	5-77	12
WINYAH 2	280	7-77	10
	------		----
	4833.		360
LIMESTONE/ALKALINE FLY ASH			
SHERBURNE 2	710	4-77	13
	------		----
	710.		13
LIMESTONE/ALKALINE FLYASH			
SHERBURNE 1	710	3-76	26
	------		----
	710.		26
MAGNESIUM OXIDE			
EDDYSTONE 1A	120	9-75	32
	------		----
	120.		32
SODIUM CARBONATE			
REID GARDNER 3	125	6-74	48

SECTION 7
SUMMARY OF OPERATING FGD SYSTEMS BY PROCESS AND GENERATING UNITS

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------------------------------------------------------------------------
    PROCESS/GENERATING UNITS          FGD/MW  STARTUP  EXPERIENCE(MO.)
------------------------------------------------------------------------

  REID GARDNER 2                        125     4-74              49
  REID GARDNER 3                        125     7-76              22
                                     ------                     ----
                                       375.                      120

         WELLMAN LORD

  SAN JUAN 1                            314     4-78               1
                                     ------                     ----
                                       314.                        1
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EPA UTILITY FGD SURVEY: APRIL 1978 - MAY 1978

SECTION 8
SUMMARY OF SLUDGE DISPOSAL PRACTICES FOR OPERATIONAL FGD SYSTEMS

PROCESS/GENERATING UNIT	--SLUDGE-- STABILIZED	--SLUDGE-- UNSTABILIZED	---POND-- LINED	---POND--- UNLINED
LIME				
BRUCE MANSFIELD 1	825			
BRUCE MANSFIELD 2	825			
CANE RUN 4	178			178
CANE RUN 5	183			183
CONESVILLE 5	400			400
CONESVILLE 6	400			400
ELRAMA POWER STATION	510			510
GREEN RIVER 1,2 & 3		64		64
HAWTHORN 3		140		140
HAWTHORN 4		100		100
HUNTINGTON 1	415			415
PADDYS RUN 6	65			65
PHILLIPS POWER STATION	410			410
TOTAL	4211.	304.	0.	2865.
LIME/ALKALINE FLYASH				
COLSTRIP 1		360	360	
COLSTRIP 2		360		360
MILTON R. YOUNG 2		450		
TOTAL	0.	1170.	360.	360.
LIMESTONE				
CHOLLA 1		115		115
CHOLLA 2		250		250
LA CYGNE 1		820		820
LAWRENCE 4		125		125
LAWRENCE 5		400		400
MARTIN LAKE 1	793		793	
MONTICELLO 3	750		750	
PETERSBURG 3	530			530
WIDOWS CREEK 8		550		550
WINYAH 2		280		280
TOTAL	2073.	2540.	1543.	3070.
LIMESTONE/ALKALINE FLY ASH				
SHERBURNE 2		710	710	
TOTAL	0.	710.	710.	0.
LIMESTONE/ALKALINE FLYASH				
SHERBURNE 1		710	710	
TOTAL	0.	710.	710.	0.
SODIUM CARBONATE				
REID GARDNER 1		125		
REID GARDNER 2		125		
REID GARDNER 3		125		
TOTAL	0.	375.	0.	0.

SECTION 9
SUMMARY OF FGD SYSTEMS BY PROCESS AND REGULATORY CLASS

PROCESS	REGULATORY CLASS	OPERATIONAL		CONSTRUCTION		CONTRACT AWARDED		PLANNED		TOTAL NO. PLANTS	
		NO.	MW	NO.	MW	NO.	MW	NO.	MW	NO.	MW
LIME	A	1	415	7	3230	2	1100	0	0	10	4745
	B	10	3971	2	420	1	825	3	1115	16	6331
	C	2	129	0	0	0	0	0	0	2	129
	D	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0
LIME/ALKALINE FLYASH	A	2	720	1	500	0	0	1	527	4	1747
	B	1	450	0	0	2	1400	3	579	6	2429
	C	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0
LIME/LIMESTONE	A	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0
	C	2	20	0	0	0	0	0	0	2	20
	D	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0
LIMESTONE	A	5	2555	14	5625	7	3869	3	1497	29	13546
	B	4	690	10	6500	1	350	3	150	18	7690
	C	2	1370	2	445	1	575	0	0	5	2390
	D	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0
LIMESTONE/ALKALINE FLY ASH	A	0	0	0	0	0	0	0	0	0	0
	B	1	710	0	0	2	1720	0	0	3	2430
	C	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0
LIMESTONE/ALKALINE FLYASH	A	0	0	0	0	0	0	0	0	0	0
	B	1	710	0	0	0	0	0	0	1	710
	C	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0
		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
SUBTOTAL - LIME/LIMESTONE	A	8.	3690.	22.	9355.	9.	4969.	4.	2024.	43.	20038.
	B	17.	6531.	12.	6920.	6.	4295.	9.	1844.	44.	19590.
	C	6.	1519.	2.	445.	1.	575.	0.	0.	9.	2539.
	D	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	E	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
AQUEOUS CARBONATE	A	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	1	400	0	0	1	400
	C	0	0	0	0	1	100	0	0	1	100
	D	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0
CITRATE	A	0	0	0	0	0	0	0	0	0	0
	B	0	0	1	60	0	0	0	0	1	60
	C	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0
DOUBLE ALKALI	A	0	0	2	825	0	0	0	0	2	825
	B	0	0	1	277	0	0	0	0	1	277
	C	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0
MAGNESIUM OXIDE	A	0	0	0	0	0	0	0	0	0	0
	B	1	120	0	0	0	0	0	0	1	120
	C	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0

A. BOILER CONSTRUCTION SUBJECT TO FEDERAL NSPS
B. BOILER SUBJECT TO STATE STANDARD THAT IS MORE STRINGENT THAN THE FEDERAL NSPS
C. BOILER SUBJECT TO STATE STANDARD THAT IS EQUAL TO OR LESS STRINGENT THAN NSPS
D. OTHER
E. REGULATORY CLASS UNKNOWN

SECTION 9
SUMMARY OF FGD SYSTEMS BY PROCESS AND REGULATORY CLASS

PROCESS	REGULATORY CLASS	OPERATIONAL		CONSTRUCTION		CONTRACT AWARDED		PLANNED		TOTAL NO. PLANTS	
		NO.	MW	NO.	MW	NO.	MW	NO.	MW	NO.	MW
NOT SELECTED	A	0	0	0	0	0	0	12	6400	12	6400
	B	0	0	0	0	0	0	6	3265	6	3265
	C	0	0	0	0	0	0	3	1240	3	1240
	D	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0
SODIUM CARBONATE	A	3	375	0	0	0	0	1	125	4	500
	B	0	0	1	509	0	0	0	0	1	509
	C	0	0	0	0	0	0	0	0	0	0
	D	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0
WELLMAN LORD	A	0	0	0	0	0	0	0	0	0	0
	B	1	314	1	506	1	268	1	472	4	1560
	C	0	0	1	180	0	0	0	0	1	180
	D	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0
WELLMAN LORD/ALLIED CHEMICAL	A	0	0	0	0	0	0	0	0	0	0
	B	0	0	0	0	0	0	0	0	0	0
	C	1	115	0	0	0	0	0	0	1	115
	D	0	0	0	0	0	0	0	0	0	0
	E	0	0	0	0	0	0	0	0	0	0
		-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
TOTALS	A	11.	4063.	24.	9980.	9.	6768.	17.	8952.	61.	27763.
	B	19.	7165.	16.	6572.	8.	5163.	19.	8107.	62.	27007.
	C	7.	1634.	3.	625.	2.	675.	3.	1240.	15.	4174.
	D	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
	E	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
LIME/STONE % OF TOTAL MW	A	91		92		100		27		72	
	B	94		82		83		65		74	
	C	93		71		85		0		61	
	D	0		0		0		0		0	
	E	0		0		0		0		0	

A. BOILERS CONSTRUCTED SUBJECT TO FEDERAL NSPS
B. BOILERS SUBJECT TO STATE STANDARD THAT IS MORE STRINGENT THAN THE FEDERAL NSPS
C. BOILERS SUBJECT TO STATE STANDARD THAT IS EQUAL TO OR LESS STRINGENT THAN NSPS
D. OTHER
E. REGULATORY CLASS UNKNOWN

SECTION 10
SUMMARY OF FGD SYSTEMS UNDER CONSTRUCTION

UTILITY COMPANY POWER STATION	NEW OR RETROFIT	SIZE OF FGD UNIT (MW)	PROCESS/VENDOR	START-UP DATE
ALABAMA ELECTRIC COOP TOMBIGBEE 2	N	225	PEABODY ENGINEERING LIMESTONE	7/78
ALABAMA ELECTRIC COOP TOMBIGBEE 3	N	225	PEABODY ENGINEERING LIMESTONE	6/79
ALLEGHENY POWER SYSTEM PLEASANTS 1	N	625	BABCOCK & WILCOX LIME	3/79
ALLEGHENY POWER SYSTEM PLEASANTS 2	N	625	BABCOCK & WILCOX LIME	3/80
ARIZONA ELECTRIC POWER COOP APACHE 2	N	200	RESEARCH COTTRELL LIMESTONE	8/78
ARIZONA ELECTRIC POWER COOP APACHE 3	N	200	RESEARCH COTTRELL LIMESTONE	4/79
BASIN ELECTRIC POWER COOP LARAMIE RIVER 1	N	570	RESEARCH COTTRELL LIMESTONE	4/80
BASIN ELECTRIC POWER COOP LARAMIE RIVER 2	N	570	RESEARCH COTTRELL LIMESTONE	10/80
BIG RIVERS ELECTRIC REID 2	N	250	AMERICAN AIR FILTER LIME	12/79
BIG RIVERS ELECTRIC REID 3	N	240	AMERICAN AIR FILTER LIME	12/80
BRAZOS ELECTRIC POWER COOP SAN MIGUEL 1	N	400	BABCOCK & WILCOX LIMESTONE	6/80
CENTRAL ILLINOIS LIGHT DUCK CREEK 1	N	400	RILEY STOKER / ENVIRONEERING LIMESTONE	8/78
CENTRAL ILLINOIS PUBLIC SERV NEWTON 1	N	575	BUELL/ENVIROTECH DOUBLE ALKALI	11/79
COLORADO UTE ELECTRIC ASSN. CRAIG 1	N	450	PEABODY ENGINEERING LIMESTONE	5/79
COLORADO UTE ELECTRIC ASSN. CRAIG 2	N	450	PEABODY ENGINEERING LIMESTONE	3/79
COMMONWEALTH EDISON POWERTON 51	R	425	AIR CORRECTION DIVISION, UOP LIMESTONE	3/79
COOPERATIVE POWER ASSOCIATION COAL CREEK 1	N	545	COMBUSTION ENGINEERING LIME	8/79
COOPERATIVE POWER ASSOCIATION COAL CREEK 2	N	545	COMBUSTION ENGINEERING LIME	11/79
DELMARVA POWER & LIGHT DELAWARE CITY 1, 2 & 3	R	180	DAVY POWERGAS WELLMAN LORD	6/80
GULF POWER SCHOLZ NOS. 1B & 2B	R	20	CHIYODA INTERNATIONAL LIMESTONE	8/78
HOOSIER ENERGY MEROM 1	N	490	MITSUBISHI INTERNATIONAL LIMESTONE	12/80
HOOSIER ENERGY MEROM 2	N	490	MITSUBISHI LIMESTONE	10/81
INDIANAPOLIS POWER & LIGHT PETERSBURG 4	N	530	RESEARCH COTTRELL LIMESTONE	6/82

SECTION 10
SUMMARY OF FGD SYSTEMS UNDER CONSTRUCTION

UTILITY COMPANY POWER STATION	NEW OR RETROFIT	SIZE OF FGD UNIT (MW)	PROCESS/VENDOR	START-UP DATE
KANSAS POWER & LIGHT JEFFEREY 1	N	680	COMBUSTION ENGINEERING LIMESTONE	6/78
KANSAS POWER & LIGHT JEFFEREY 2	N	680	COMBUSTION ENGINEERING LIMESTONE	6/80
LOUISVILLE GAS & ELECTRIC CANE RUN 6	N	277	ADL/COMBUSTION EQUIP ASSOCIATE DOUBLE ALKALI	12/78
LOUISVILLE GAS & ELECTRIC MILL CREEK 3	N	425	AMERICAN AIR FILTER LIME	7/78
LOUISVILLE GAS & ELECTRIC MILL CREEK 4	N	495	AMERICAN AIR FILTER LIME	6/80
MINNESOTA POWER & LIGHT CLAY BOSWELL 4	N	500	PEABODY ENGINEERING LIME/ALKALINE FLYASH	5/80
PACIFIC POWER & LIGHT JIM BRIDGER 4	N	509	AIR CORRECTION DIVISION, UOP SODIUM CARBONATE	9/79
PUBLIC SERVICE OF NEW MEXICO SAN JUAN 2	N	306	DAVY POWERGAS/ALLIED CHEMICAL WELLMAN LORD	7/78
SALT RIVER PROJECT CORONADO 1	N	350	PULLMAN KELLOGG LIMESTONE	4/79
SALT RIVER PROJECT CORONADO 2	N	350	PULLMAN KELLOGG LIMESTONE	4/80
SIKESTON BOARD OF MUNIC. UTIL. SIKESTON POWER STATION	N	235	BABCOCK & WILCOX LIMESTONE	6/81
SOUTH CAROLINA PUBLIC SERVICE WINYAH 3	N	[illegible]	BABCOCK & WILCOX LIMESTONE	5/80
SOUTHERN ILLINOIS POWER COOP MARION 4	N	184	BABCOCK & WILCOX LIMESTONE	8/78
SOUTHERN INDIANA GAS & ELEC A. B. BROWN 1	N	250	FMC CORPORATION DOUBLE ALKALI	4/79
SOUTHERN MISSISSIPPI ELECTRIC R. D. MORROW 1	N	[illegible]	RILEY STOKER / ENVIRONEERING LIMESTONE	8/78
SOUTHERN MISSISSIPPI ELECTRIC R. D. MORROW 2	N	[illegible]	RILEY STOKER / ENVIRONEERING LIMESTONE	10/78
ST. JOE MINERALS CORP. G. F. WEATON 1	R	60	BUREAU OF MINES CITRATE	10/78
TEXAS UTILITIES MARTIN LAKE 2	N	793	RESEARCH COTTRELL LIMESTONE	5/78
TEXAS UTILITIES MARTIN LAKE 3	N	793	RESEARCH COTTRELL LIMESTONE	12/78
UTAH POWER & LIGHT EMERY 1	N	[illegible]	CHEMICO LIME	12/78

SECTION 11
SUMMARY OF PLANNED FGD SYSTEMS

UTILITY COMPANY POWER STATION	NEW OR RETROFIT	SIZE OF FGD UNIT (MW)	VENDOR/PROCESS	START-UP DATE
CONTRACTS AWARDED				
ARIZONA PUBLIC SERVICE CHOLLA 4		350	RESEARCH COTTRELL LIMESTONE	6/80
ASSOCIATED ELECTRIC COOP THOMAS HILL 3	N	670	PULLMAN KELLOGG LIMESTONE	0/81
CINCINNATI GAS & ELECTRIC EAST BEND 2	N	600	BABCOCK & WILCOX LIME	1/81
EASTERN KENTUCKY POWER COOP SPURLOCK 2	N	500	COMBUSTION ENGINEERING LIME	3/80
LAKELAND UTILITIES MCINTOSH 3	N	350	BABCOCK & WILCOX LIMESTONE	10/81
MONTANA POWER COLSTRIP 3	N	700	ADL/COMBUSTION EQUIP ASSOCIATE LIME/ALKALINE FLYASH	7/80
MONTANA POWER COLSTRIP 4	N	700	ADL/COMBUSTION EQUIP ASSOCIATE LIME/ALKALINE FLYASH	7/81
NIAGARA MOHAWK POWE COOP CHARLES R. HUNTLEY	N	100	ATOMICS INTERNATIONAL AQUEOUS CARBONATE	0/80
NORTHERN STATES POWR SHERBURNE 3	N	860	COMBUSTION ENGINEERING LIMESTONE/ALKALINE FLY ASH	5/81
NORTHERN STATES POWR SHERBURNE 4	N	860	COMBUSTION ENGINEERING LIMESTONE/ALKALINE FLY ASH	5/83
OTTER TAIL POWER COYOTE 1	N	400	WHEELABRATOR-FRYE/A.I. AQUEOUS CARBONATE	5/81
PENNSYLVANIA POWER BRUCE MANSFIELD 3	N	825	PULLMAN KELLOGG LIME	4/80
PUBLIC SERVICE OF NM MEXICO SAN JUAN 3	N	468	DAVY POWERGAS WELLMAN LORD	1/81
SOUTHWESTERN ELECTRIC POWER HENRY W. PIRKEY 1		720	AIR CORRECTION DIVISION, UOP LIMESTONE	6/83
SPRINGFIELD WATER LIGHT & PWR DALLMAN 3	N	190	RESEARCH COTTRELL LIMESTONE	7/80
TENNESSEE VALLEY AUTHORITY WIDOWS CREEK 7	R	575	COMBUSTION ENGINEERING LIMESTONE	0/ 0
TEXAS MUNICIPAL POWR AGENCY GIBBONS CREEK 1	N	400	COMBUSTION ENGINEERING LIMESTONE	1/82
TEXAS POWER & LIGHT SANDOW 4	N	545	COMBUSTION ENGINEERING LIMESTONE	7/80
TEXAS UTILITIES MARTIN LAKE 4	N	793	RESEARCH COTTRELL LIMESTONE	11/82
LETTER OF INTENT SIGNED				
NEVADA POWER REID GARDNER 4	N	125	ADL/COMBUSTION EQUIP ASSOCIATE SODIUM CARBONATE	0/ 0
PHILADELPHIA ELECTRIC EDDYSTONE 1B	R	240	UNITED ENGINEERS / PECO MAGNESIUM OXIDE	6/80
WISCONSIN POWER & LIGHT COLUMBIA 2	N	527	CHEMICO LIME/ALKALINE FLYASH	1/81

SECTION 11
SUMMARY OF PLANNED FGD SYSTEMS

UTILITY COMPANY POWER STATION	NEW OR RETROFIT	SIZE OF FGD UNIT (MW)	VENDOR/PROCESS	START-UP DATE
REQUESTING/EVALUATING BIDS				
BASIN ELECTRIC POWER COOP ANTELOPE VALLEY 1	N	455	NOT SELECTED LIME	11/81
CENTRAL ILLINOIS LIGHT DUCK CREEK 2	N	400	NOT SELECTED LIMESTONE	1/82
CONSIDERING FGD SYSTEM				
ARIZONA PUBLIC SERVICE FOUR CORNERS 1	R	175	CHEMICO/APS LIME/ALKALINE FLYASH	0/ 0
ARIZONA PUBLIC SERVICE FOUR CORNERS 2	R	175	CHEMICO/APS LIME/ALKALINE FLYASH	0/ 0
ARIZONA PUBLIC SERVICE FOUR CORNERS 3	R	229	CHEMICO/APS LIME/ALKALINE FLYASH	0/ 0
ARIZONA PUBLIC SERVICE FOUR CORNERS 4	R	755	NOT SELECTED NOT SELECTED	0/ 0
ARIZONA PUBLIC SERVICE FOUR CORNERS 5	R	755	NOT SELECTED NOT SELECTED	0/ 0
BASIN ELECTRIC POWER COOP ANTELOPE VALLEY 2	N	455	NOT SELECTED NOT SELECTED	11/83
BASIN ELECTRIC POWER COOP LARAMIE RIVER 3	N	550	NOT SELECTED NOT SELECTED	4/82
CENTRAL MAINE POWER SEARS ISLAND 1	N	600	NOT SELECTED NOT SELECTED	11/86
COLUMBUS & SOUTHERN OHIO ELEC. POSTON 5	N	375	NOT SELECTED NOT SELECTED	8/83
COLUMBUS & SOUTHERN OHIO ELEC. POSTON 6	N	375	NOT SELECTED NOT SELECTED	8/85
GENERAL PUBLIC UTILITIES COHO 1	N	800	NOT SELECTED NOT SELECTED	5/87
GENERAL PUBLIC UTILITIES SEWARD 7	N	800	NOT SELECTED NOT SELECTED	5/86
LOUISVILLE GAS & ELECTRIC MILL CREEK 1	R	330	NOT SELECTED LIME	1/82
LOUISVILLE GAS & ELECTRIC MILL CREEK 2	R	330	NOT SELECTED LIME	1/81
NEVADA POWER HARRY ALLEN 1	N	500	NOT SELECTED NOT SELECTED	6/82
NEVADA POWER HARRY ALLEN 2	N	500	NOT SELECTED NOT SELECTED	6/84
NEVADA POWER HARRY ALLEN 3	N	500	NOT SELECTED NOT SELECTED	6/85
NEVADA POWER HARRY ALLEN 4	N	500	NOT SELECTED NOT SELECTED	6/86
NEVADA POWER WARNER VALLEY 1	N	250	NOT SELECTED NOT SELECTED	[illegible]
NEVADA POWER WARNER VALLEY 2	N	250	NOT SELECTED NOT SELECTED	[illegible]

SECTION 11
SUMMARY OF PLANNED FGD SYSTEMS

UTILITY COMPANY POWER STATION	NEW OR RETROFIT	SIZE OF FGD UNIT (MW)	VENDOR/PROCESS	START-UP DATE
NEW ENGLAND ELEC SYSTEM BRAYTON POINT 3	N	650	NOT SELECTED NOT SELECTED	0/ 0
NORTHERN INDIANA PUB SERVICE BAILLY 7	N	190	NOT SELECTED NOT SELECTED	0/ 0
NORTHERN INDIANA PUB SERVICE BAILLY 8	N	400	NOT SELECTED NOT SELECTED	0/ 0
PACIFIC GAS AND ELECTRIC FOSSIL 1	N	800	NOT SELECTED LIMESTONE	0/84
PACIFIC GAS AND ELECTRIC FOSSIL 2	N	800	NOT SELECTED LIMESTONE	0/85
PHILADELPHIA ELECTRIC CROMBY	R	150	UNITED ENGINEERS / PECO MAGNESIUM OXIDE	6/80
PHILADELPHIA ELECTRIC EDDYSTONE 2	R	336	UNITED ENGINEERS / PECO MAGNESIUM OXIDE	6/80
PUBLIC SERVICE OF INDIANA GIBSON 5	N	650	NOT SELECTED NOT SELECTED	0/82
PUBLIC SERVICE OF NEW MEXICO SAN JUAN 4	N	472	DAVY POWERGAS WELLMAN LORD	1/82
SALT RIVER PROJECT CORONADO 3	N	350	NOT SELECTED LIMESTONE	0/87
SOUTHERN ILLINOIS POWER COOP MARION 5	N	500	NOT SELECTED NOT SELECTED	1/84
TEXAS POWER & LIGHT TWIN OAKS 1	N	750	NOT SELECTED LIMESTONE	8/83
TEXAS POWER & LIGHT TWIN OAKS 2	N	750	NOT SELECTED LIMESTONE	9/84
TEXAS UTILITIES FOREST GROVE 1	N	750	NOT SELECTED NOT SELECTED	6/81

SECTION 13

TOTAL FGD MEGAWATT CAPACITY BY YEAR *

YEAR	NO. UNITS	MEGAWATTS
1966	1	360
1968	1	125
1971	1	400
1972	4	290
1973	4	1410
1974	2	250
1975	4	1656
1976	5	1953
1977	19	4921
1978	20	7252
1979	13	5090
1980	25	9863
1981	12	6300
1982	9	4375
1983	7	5410
1984	5	3150
1985	3	1675
1986	2	1100
1987	2	1150
UNDETERMINED	15	4427

* TOTALS DISPLAYED DO NOT INCLUDE TERMINATED OR INACTIVE SYSTEMS.

APPENDIX A

FGD SYSTEMS ECONOMICS

INTRODUCTION

The cost of flue gas desulfurization (FGD) systems for the control of sulfur dioxide emissions is an area of intense interest and substantial controversy. As a result, many computer models have recently been developed to estimate capital and annual costs. As part of an effort by the U.S. Environmental Protection Agency to provide meaningful economic data concerning FGD systems, reported economic data have been incorporated into the EPA Utility FGD Survey report. This information has appeared as a separate appendix of the report since October 1976. Until January 1978, this cost appendix consisted entirely of data reported by the utilities with little or no interpretation provided by PEDCo Environmental, Inc. Beginning with the May 1978 report, the format and content of the cost appendix were revised to include reported and adjusted costs for the operational FGD systems.

The rationale for including adjusted as well as reported costs stems primarily from the lack of comparability of the reported costs. Many of the reported cost figures, both capital and operating, are largely site-sensitive values that cannot be accurately compared because they refer to different FGD battery limits and different years in which the expenditures were made. As a result, an analysis of the cost data was made for the operational units since these systems offer the potential of having complete and accurate economic data. The adjustments were made to provide comparable, accurate cost data for the sulfur dioxide portion of the emission control system. This, in effect, will eliminate much of the confusion that exists concerning the reported data, and it will provide a common basis for the reported costs.

APPROACH

In March 1978, each utility having at least one operational FGD system was given a cost form containing all available cost information then in the PEDCo files. The utility was asked to verify the data and fill in any missing information called for on the form. A follow-up visit by the PEDCo Environmental staff was arranged to assist in data acquisition and to insure completeness and reliability of information. Results of the cost analysis were forwarded to each participating utility for final review and comment.

The cost data were treated solely to establish the accurate costs for FGD systems, on a common basis, not to critique the design or reasonableness of the costs reported by any utility. Adjustments focused primarily on the following items:

- All capital costs were adjusted to July 1, 1977, dollars using the Chemical Engineering Index. All capital costs, represented in dollars/kilowatt ($/kW), were expressed in terms of gross megawatts (MW). Actual costs were reported by utilities in dollar values for years 1970 to 1980. These values are represented in terms of the year of greatest capital expenditures.

- Gross unit capacity was used to express all FGD capital expenditures because the capital requirement of an FGD system is dependent on actual boiler size before derating for auxiliary and air quality control power requirements.

- Particulate control costs were deducted. Since the purpose of the study was to estimate the incremental cost for sulfur dioxide control, particulate control costs were deducted using either data contained in the cost breakdowns or as a percentage of the total direct cost (capital and annual). The percentage reduction varied depending upon system design and operation.

- The capital costs associated with the modification or installation of equipment not part of the FGD system but needed for its proper functioning, were included (e.g. - stack lining, modification to existing ductwork or fans, etc.).

- Indirect charges were adjusted to provide adequate funds for engineering, field expenses, legal expenses, insurance, interest during construction, allowance for startup, taxes, and contingency.

- All annual costs, represented in mills/kilowatt-hour (mills/kWh), were expressed in terms of net megawatts (MW).

- Net unit capacity was used to express all FGD annual expenditures because the annual cost requirement of an FGD system is dependent on the actual amount of kilowatt-hours (kWh) produced by the unit after derating for auxiliary and air quality control power requirements.

- All annual costs were adjusted to a common capacity factor (65 percent).

- Replacement power costs were not included since only a few utilities reported such costs and these were presented using a variety of methods.

- Sludge disposal costs were adjusted to reflect the costs of sulfur dioxide waste disposal only (i.e., excluding fly ash disposal) and to provide for disposal over the anticipated lifetime of the FGD system. This latter correction was necessary since several utilities reported costs for sludge disposal capacity that would last only a fraction of the FGD system life. The adjustments were based on a land cost of $2000/acre with a sludge depth of 50 ft in a clay-lined pond (clay is assumed to be available at the site).

- A 30-year life was assumed for all process and economic considerations for all new systems that were installed for the life of the unit. A 20-year life was assumed for all process and economic considerations for retrofit systems that were installed for the remaining portion of the life of the unit.*

- Regeneration and by-product recovery facility costs were added for those regenerable systems not reporting such costs.

To the extent possible, all cost adjustments were made using the previous assumptions developed by PEDCo Environmental. When cost data were inadequate, adjustments were made using process design data in conjunction with the previous cost assumptions. In some cases, no adjustments were possible because of insufficient data.

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* The use of a 30-year service life for new units coincides with the conclusion of the National Power Survey of the Federal Power Commission which recognized this value as reasonable for steam-electric plants. A 20-year service life was assumed for all retrofit units even if the remaining life of the units is less than this value. Thus, two different rates are used and should be noted when making comparisons between new and retrofit systems.

DESCRIPTION OF COST ELEMENTS

Capital costs consist of direct costs, indirect costs, contingency costs, and other capital costs. Direct costs include the "bought-out" cost of the equipment, the cost of installation, and site development. Indirect costs include interest during construction, contractor's fees and expenses, engineering, legal expenses, taxes, insurance, allowance for start-up and shakedown, and spares. Contingency costs include those costs resulting from malfunctions, equipment alterations, and similar unforeseen sources. Other capital costs include the nondepreciable items of land and working capital.

Annual costs consist of direct costs, fixed costs, and overhead costs. Direct costs include the cost of raw materials, utilities, operating labor and supervision, and maintenance and repairs. Fixed costs include those of depreciation, interim replacement, insurance, taxes, and interest on borrowed capital. Overhead costs include those of plant and payroll expenses. The various capital and annual cost components are discussed and defined in greater detail in the following paragraphs.

The direct capital costs include the following elements:

- Equipment required for the FGD system. Table A-1 provides a summary of the major process equipment used in regenerable and nonregenerable systems.
- Installation of equipment, including foundations; steel work for support, buildings, piping and ducting for effluents, slurries, sludge, and make-up water, control panels, instrumentation, insulation of ducting, buildings, piping, and other equipment, painting and piling.
- Site development may include clearing and grading, construction of access roads and walkways, establishment of rail, barge, and/or truck facilities, and parking facilities.

TABLE A-1. MAJOR FGD SYSTEM EQUIPMENT SUMMARY

Category	Description
Material handling-raw materials	Equipment for the handling and transfer of raw materials includes unloading facilities, conveyors, storage areas and silos, vibrators, atmospheric emission control associated with these facilities, and related accessories.
Feed preparation-raw materials	Equipment for the preparation of raw material to produce a feed slurry consists of feed weighers, crushers, grinders, classifiers, ball mills, mixing tanks, pumps, agitators, and related accessories.
Sulfur dioxide absorption	Equipment for treating the flue gas includes absorbers, mist eliminators, hold tanks, agitators, circulating pumps, pond water return pumps, and related accessories.
Flue gas reheat	Equipment required includes air, steam, or hot water heaters, condensate tanks, pumps, soot blowers, fans, fuel storage facilities, gas bypass equipment, and related accessories.
Gas handling	Equipment to handle the boiler flue gas includes booster fans, ductwork, flue gas bypass system, turning vanes, supports, platforms, and related accessories.
Sludge disposal	Nonregenerable FGD systems require solids/water separation equipment such as clarifiers, vacuum filters, centrifuges, sludge fixation equipment, and related accessories.
Utilities	Equipment to supply power and water to the FGD equipment consists of switch-gear, breakers, transformers, piping, and related accessories.
By-product handling	Equipment for processing the by-product of regenerable FGD systems may include a rotary kiln, fluid bed dryer, conveyor, storage silo, vibrator, combustion equipment and oil storage tanks, waste heat boilers, hammer mills, evaporators, crystallizers, strippers, tanks, agitators, pumps, compressors, sulfuric acid absorber and cooling, mist eliminator, pumps, acid coolers, tanks, etc.

(continued)

TABLE A-1. (continued)

Category	Description
Regeneration	Equipment for regeneration of the absorbing medium of an FGD system may consist of reactor vessels, material handling system, storage, weigh feeder, conveyor, rotary kiln, fluid bed calciner, dust collector, storage silo, vibrator, combustion equipment and oil storage tanks, waste heat boiler, hammer mill, evaporators, crystallizers, strippers, tanks, agitators, pumps, compressors, sulfuric acid absorber and cooling, mist eliminator, pumps, acid coolers, tanks, etc.
Purge treatment	Equipment for the removal of purge material (e.g. sodium sulfate) includes refrigeration, pumps, tanks, crystallizer, centrifuge, dryer, dust collector, conveyors, storage, and related equipment.
Auxiliary	Equipment not directly related to the FGD system, but which may require design or modification to accommodate an FGD system may include such items as existing fans, ducts, or stack. If new fans, ducts, or stacks are added to improve boiler performance and accommodate the FGD system, the costs are prorated to the boiler and FGD system.

Indirect capital costs include the following elements:

- Interest accrued on borrowed capital during construction.
- Contractor's fee and expenses, including costs for field labor payroll; field office supervision; personnel; construction offices; temporary roadways; railroad trackage; maintenance and welding shops; parking lot; communications; temporary piping and electrical and sanitary facilities; safety security (fire, material, medical, etc.); construction tools and rental equipment; unloading and storage of materials; travel expenses; permits; licenses; taxes; insurance; overhead; legal liabilities; field testing of equipment; start-up; and labor relations.
- Engineering costs, including administrative, process, project, and general; design and related functions for specifications; bid analysis; special studies; cost analysis; accounting; reports; consultant fees; purchasing; procurement; travel expenses; living expenses; expediting; inspection; safety; communications; modeling; pilot plant studies (if required because of process design or application novelty); royalty payments during construction; training of plant personnel; field engineering; safety engineering; and consultant services.
- Legal expenses, including those for securing permits, rights-of-way, etc.
- Taxes, including sales, and excise taxes.
- Insurance covering liability for equipment in transit and at site; fire, casualty, injury, and death; damage to property; delay; and noncompliance.
- Allowance for start-up and shakedown includes the cost associated with system start-up.
- Spare parts including pumps, valves, controls, special piping and fittings, instruments, spray nozzles, and similar items.

Other capital costs include the following elements:

- Land required for the FGD process, waste disposal, regeneration facility, and storage.
- Working capital, including the total amount of money invested in raw materials and supplies in stock, finished products in stock, and unfinished products

in the process of being manufactured; accounts receivable; cash kept on hand for payment of operating expenses such as salaries, wages, and raw materials purchases; accounts payable; and taxes payable.

Annual cost of an FGD system includes the following direct, fixed and overhead charges:

- Direct Charges
  - Raw materials, including those required by the FGD process for sulfur dioxide control, absorbent regeneration, sludge treatment, sludge fixation, flocculants, etc.
  - Utilities, including water for slurries, cooling and cleaning; electricity for pumps, fans, valves, lighting controls, conveyors, and mixers; fuel for reheating of flue gases; and stream for processing.
  - Operating labor, including supervisory, skilled, and unskilled labor required to operate, monitor, and control the FGD process.
  - Maintenance and repairs, consisting of both manpower and materials to keep the unit operating efficiently. The function of maintenance is both preventive and corrective to keep outages to a minimum.
  - Byproduct Sales: credit from the sale of byproducts regenerable FGD processes (e.g. sulfur, sulfuric acid) is a negative charge deducted from the annual direct cost to obtain the net annual direct cost of the FGD system.
- Fixed Charges
  - Depreciation - the annual charge to recover direct and indirect costs of physical assets over the life of the asset.
  - Interim, replacement - costs expended for temporary or provisional replacement of equipment that has failed or malfunctioned prematurely.
  - Insurance, including the costs of protection from loss by a specified contingency, peril, or unforeseen event. Required coverage could include losses due to fire, personal injury or death, property damage, explosion, lightning, or other natural phenomena.

- Taxes, including franchise, excise, and property taxes levied by a city, county, state, or Federal government.

- Interest on borrowed funds.

- Overhead

  Plant and administrative overhead is a business expense that is not charged directly to a particular part of a project, but is allocated to it. Overhead costs include administrative, safety, engineering, legal and medical services; payroll; employee benefits; recreation; and public relations.

Table A-2 provides a summary of the means used to determine the missing cost elements if the costs were not reported or insufficient information prevented their actual determination. The assumptions and cost bases for determining the capital and annual costs of FGD systems were developed by the PEDCo staff based upon previous economic studies conducted for the U.S. EPA (Flue Gas Desulfurization Process Cost Assessment, May 1975; Simplified Procedures for Estimating Flue Gas Desulfurization System Costs, June 1976, EPA-600/2-76-150; Particulate and Sulfur Dioxide Emission Control Costs for Large Coal-Fired Boilers, March 1978, EPA-600/7-78-032).

TABLE A-2. COST ELEMENT FACTORS

Category	Value
Indirect capital costs:	
Interest during construction	10% of total direct capital costs
Field overhead	10% of total direct capital costs
Contractor's fee and expenses	5% of total direct capital costs
Engineering	10% of total direct capital costs
Taxes	2% of total direct capital costs
Spares	1% of total direct capital costs
Shakedown allowance	5% of total direct capital costs
Other capital costs:	
Contingency[a]	20% of total direct and indirect capital costs
Direct annual costs:	
Raw materials:	
Fixation chemicals	$2/ton
Lime	$40/ton
Limestone	$10/ton
Magnesium oxide	$150/ton
Sodium carbonate	$80/ton
Salt cake (credit)	$50/ton
Sulfur (credit)	$65/ton
Sulfuric acid (credit)	$25/ton
Utilities:	
Electricity	25 mills/kWh
Water	$\$0.20/10^3$ gal
Steam	$\$0.80/10^6$ Btu
Operating labor:	
Direct labor	$8.50/man-hour
Supervision	15% of direct labor costs

[a] Contingency costs are used only when the cost data supplied are incomplete (such as equipment costs or direct costs only) and a contingency cost must be factored in to give an accurate estimate of the total capital cost.

(continued)

TABLE A-2. (continued)

Category	Value
Maintenance:	
Labor and materials	4% of total direct capital costs
Supplies	15% of labor and materials costs
Overhead:	
Plant	50% of operation and maintenance costs
Payroll	20% of operating labor costs
Fixed annual costs:	
Depreciation	3.33% or 5% (new or retrofit)
Interim replacement[b]	0.7% or 0.35%
Taxes	4%
Insurance	0.3%
Capital costs	9%

[b] Some system components have life spans less than the expected service life of the system. Interim replacement is an allowance factor used in estimating annual revenue requirements to provide for the replacement of these short-lived items. An average allowance of 0.35% of the total investment is normally provided and used for systems with an expected service life of 20 years or less. A higher allowance of 0.70% of the total investment is provided and used for systems with an expected service life of 30 years or more.

DEFINITION OF COST ELEMENTS

The costs displayed in Appendix A are accompanied by a series of alphabetic characters summarizing data presented for each FGD system. These relate to the cost elements described earlier in this section and identify what has been included and excluded for reported and adjusted capital and annual costs. The alphabetic characters, along with their titles, are briefly described in Table A-3.

TABLE A-3. DESCRIPTION OF COST

Code	Title	Description
A	Particulate control (required for FGD process) included in capital cost.	Particulate precollection device (ESP, fabric filter, venturi) prior to FGD system required for proper operation of SO_2 control system.
B	Particulate control (included in FGD process) included in capital cost.	Particulate collection equipment (venturi scrubber) is included in the FGD system.
C	Total direct capital costs included.	Complete cost of all FGD equipment, the labor and materials required for equipment installation, and interconnecting the system is included in the total capital cost.
D	Partial direct capital costs included.	One or a number of direct cost items, or the cost associated with one or a number of direct cost items, are excluded from the total capital cost.
E	Total indirect capital costs included.	Complete cost of all the indirect cost elements, including interest during construction, contractor's fees, engineering, legal expenses, taxes, insurance, allowance for start-up, and spares, is included in total capital cost.
F	Partial indirect costs included.	One or a number of indirect cost items, or the cost associated with one or a number of indirect cost items, are excluded from the total capital cost.
G	Chemical fixation of sludge included in capital cost.	The cost of a chemical fixation process which stabilizes the flue gas cleaning wastes prior to disposal is included in the total capital cost.
H	Dry sludge disposal included in capital cost.	The cost of a secondary dewatering or treatment method, such as filtration, centrifugation, or forced oxidation, which ultimately produces a dry sludge cake for final disposal, is included in the total capital cost.
I	Off-site landfill area included in capital cost.	The cost of an off-site area used as a landfill for flue gas cleaning wastes is included in the total capital cost.
J	Sludge pond included in capital cost.	The cost of an on-site disposal area for ponding of treated or untreated flue gas cleaning wastes is included in the total capital cost.
K	Additional sludge disposal capacity added for life of system.	The cost of additional SO_2 waste disposal capacity required for FGD system operation over the anticipated service life of the unit is included in the total capital cost.
L	Stack included in capital cost.	The cost of the stack is included in the total capital cost.
M	Modifications to stack, ducts, and/or fans included in capital cost.	Modifications to existing equipment (stack, fans, ducts, etc.) which are required because of inclusion of an FGD system.
N	Total regeneration facility cost included in capital cost.	Complete cost of entire regeneration facility included in total capital cost.
O	Partial regeneration facility cost included in capital cost.	Part of the cost associated with the regeneration facility included in the total capital cost.
P	R & D costs included in capital cost.	Bench scale or pilot plant studies to determine process and design characteristics.

(continued)

TABLE A-3. (continued)

Code	Title	Description
Q	Costs underwritten by system supplier included in capital cost.	Capital expenditures underwritten by the system supplier for system repairs or modifications for optimization of performance or R & D programs.
R	Excess reagent supply costs included in capital cost.	Capital expenditures for reagent supply exceeds the amount required for the period of initial operation.
S	Total direct annual costs included.	Complete cost of all raw materials, utilities, operating labor and maintenance and repairs is included in the total annual cost.
T	Partial direct annual costs included.	One or a number of direct annual cost items, or the cost associated with one or a number of direct annual cost items, are excluded from the total annual cost.
U	Total fixed annual costs included.	Complete cost of all fixed cost elements, including depreciation, interim replacement, insurance, taxes, and interest, is included in the total annual cost.
V	Partial fixed annual costs included.	One or a number of fixed annual cost items, or the cost associated with one or a number of fixed annual cost items, are excluded from the total annual cost.
W	Overhead cost included in total annual cost.	Plant and payroll overhead costs are included in the total annual cost.
X	Particulate control costs included in direct annual cost.	The cost of operating particulate collection equipment included in the FGD system is included in the total annual cost.
Y	Sludge disposal service costs (contract) included in direct annual cost.	The treatment and disposal of flue gas cleaning wastes that are handled by an outside firm.
Z	Replacement energy costs included in total annual costs.	The cost of additional power-generating capacity required to compensate for power used by the FGD system.

RESULTS OF COST ANALYSIS

The results of the operational FGD system survey are summarized in Tables A-4 and A-5. Table A-4 summarizes the reported and adjusted capital and annual costs for all the operational FGD systems addressed in the survey. Table A-5 produces a summary of a categorical analysis of the reported and adjusted capital and annual costs for the operational FGD systems addressed in the survey. Included in this categorical analysis are the ranges, means, and standard deviation for all the various types and categories of FGD systems examined.

TABLE A-4. REPORTED AND ADJUSTED CAPITAL AND ANNUAL COSTS FOR ALL OPERATIONAL FGD SYSTEMS

	Reported		Adjusted	
	Capital $/kW	Annual mills/kWh	Capital $/kW	Annual mills/kWh
Cholla 1	52.0	2.19	56.0	2.58
Conesville 5	55.6	4.71	70.8	7.42
Elrama 1-4	113.5	5.31	134.5	8.59
Phillips 1-6	107.0	7.83	149.7	9.54
Petersburg 3[a]	99.5		100.6	6.56
Hawthorn 3-4	27.0	8.40	87.3	4.09
La Cygne 1	53.7	1.70	68.0	3.78
Green River 1-3	70.3	14.35	77.6	5.24
Cane Run 4	66.6	2.75	80.6	8.64
Cane Run 5[a]	62.4		67.5	5.56
Paddys Run 6[b]	52.9		76.5	6.51
M.R. Young 2[a]	86.0		93.1	5.55
Colstrip 1-2	77.1	0.27	77.3	4.06
Reid Gardner 1-2	42.9	2.10	60.9	3.20
Reid Gardner 3	113.6	2.10	107.9	4.38
D.H. Mitchell 11[c]				
Sherburne 1-2	49.3	1.99	71.5	2.77
B. Mansfield 1-2	120.7	13.18	102.2	7.67
Eddystone 1A[d]	156.8		233.3	
Winyah 2	47.5	1.61	66.5	2.92
Southwest 1[a]	77.3		117.7	6.17
Widows Creek 8	98.2	3.00	113.2	5.28

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[a] Annual costs were not reported by the utility for this system because of the lack of meaningful data due to recent operating status.

[b] Annual costs were not reported by the utility for this system because of the lack of meaningful data due to peak load status of unit.

[c] Reported and adjusted cost data are being assembled by project participants.

[d] Annual cost data are being assembled by the utility.

TABLE A-5. CATEGORICAL RESULTS OF THE REPORTED AND ADJUSTED CAPITAL AND ANNUAL COSTS FOR OPERATIONAL FGD SYSTEMS

	Reported						Adjusted					
	Capital			Annual			Capital			Annual		
	Range, $/kW	Avg., $/kW	σ	Range, mills/kWh	Avg., mills/kWh	σ	Range, $/kW	Avg., $/kW	σ	Range, mills/kWh	Avg., mills/kWh	σ
All	27.0-156.8	77.6	32.2	0.27-14.35	4.77	4.32	56.0-233.3	95.8	40.1	2.58-9.54	5.53	2.09
New	47.5-120.7	78.0	26.8	0.27-13.18	3.65	4.41	66.5-117.7	87.6	18.9	2.77-7 67	5.13	1.79
Retrofit	27.0-156.8	77.2	37.8	2.10-14.35	5.74	4.28	56.0-233.3	103.4	52.5	2.58-9.54	5.92	2.38
Nonregenerable	27.0-120.7	73.7	27.3	0.27-14.35	4.77	4.32	56.0-149.7	89.0	25.4	2.58-9.54	5.53	2.09
Regenerable	156.8	156.8					233.3	233.3				
Limestone	57.5-99.5	71.4	23.7	1.61-3.00	2.13	0.64	56.0-117.7	87.0	26.7	2.58-6.56	4.55	1.69
Lime	27.0-120.7	75.1	31.7	2.75-14.35	8.08	4.34	67.5-149.7	94.1	29.3	4.09-9.54	7.03	1.81
Alkaline/fly ash/limestone	49.3	49.3		1.99	1.99		71.5	71.5		2.77	2.77	
Alkaline fly ash/lime	77.1-86.0	81.6	6.3	0.27	0.27		77.3-93.1	85.2	11.2	4.06-5.55	4.81	1.05
Sodium carbonate	42.9-113.6	78.3	50.0	2.10	2.10		60.9-107.9	84.4	33.2	3.20-4.38	3.79	0.83
Magnesium oxide	156.8	156.8					2.33.3	233.3				

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SECTION A-1 FGD SYSTEM ECONOMICS: OPERATIONAL SYSTEMS

REPORTED AND ADJUSTED COSTS

UTILITY STATION UNIT(S)	FGD MW	ELEMENTS INCLUDED IN CAPITAL AND ANNUAL COSTS	CAPACITY FACTOR %	TOTAL CAPITAL $/KW (YEAR)	ANNUAL - MILLS/KWH TOTAL	DIRECT (YEAR)	FIXED
ARIZONA PUBLIC SERVICE	126	B,C,E,S,U,X	*************** REPORTED ***************				
CHOLLA			85	52.0	2.19		
1				(1973)		(1976)	
		C,E,I,K,S,U	*************** ADJUSTED ***************				
		,W	65	56.0	2.58	.48	2.10
				(1977)		(1977)	
COLUMBUS & SOUTHERN OHIO ELEC.	411	B,C,J,M,T,X	*************** REPORTED ***************				
CONESVILLE		,Y	51	55.6	4.71	4.71	
5				(1975)		(1977)	
		C,E,J,M,S,U	*************** ADJUSTED ***************				
		,W,Y	65	70.8	7.42	5.06	2.36
				(1977)		(1977)	
DUQUESNE LIGHT	510	B,D,F,I,J,M	*************** REPORTED ***************				
ELRAMA POWER STATION		,T,V,X,Y	64	113.5	5.31	2.82	2.49
				(1976)		(1977)	
		C,E,I,J,M,S	*************** ADJUSTED ***************				
		,U,Y	65	127.2	7.81	3.36	4.45
				(1977)		(1977)	
DUQUESNE LIGHT	410	B,D,F,I,J,M	*************** REPORTED ***************				
PHILLIPS POWER STATION		,T,V,X,Y	70	106.9	7.83	3.69	4.14
				(1972)		(1977)	
		C,E,I,J,M,S	*************** ADJUSTED ***************				
		,U,Y	65	140.6	8.57	3.58	4.99
				(1977)		(1977)	
INDIANAPOLIS POWER & LIGHT	532	C,F,H,J,M	*************** REPORTED ***************				
PETERSBURG				99.5			
3				(1976)			
		C,E,H,J,M,S	*************** ADJUSTED ***************				
		,U,W,Y	65	100.6	6.56	3.57	2.99
				(1977)		(1977)	

COST ELEMENTS

CAPITAL:

A - PARTICULATE CONTROL (REQUIRED FOR FGD PROCESS) INCLUDED IN CAPITAL COST
B - PARTICULATE CONTROL (INCLUDED IN FGD PROCESS) INCLUDED IN CAPITAL COST
C - TOTAL DIRECT CAPITAL COSTS INCLUDED
D - PARTIAL DIRECT CAPITAL COSTS INCLUDED
E - TOTAL INDIRECT CAPITAL COSTS INCLUDED
F - PARTIAL INDIRECT CAPITAL COSTS INCLUDED
G - CHEMICAL FIXATION OF SLUDGE INCLUDED IN CAPITAL COST
H - DRY SLUDGE DISPOSAL INCLUDED IN CAPITAL COST
I - OFF-SITE LANDFILL AREA INCLUDED IN CAPITAL COST
J - SLUDGE POND INCLUDED IN CAPITAL COST
K - ADDITONAL SLUDGE DISPOSAL CAPACITY ADDED FOR LIFE OF SYSTEM
L - STACK INCLUDED IN CAPITAL COST
M - MODIFICATIONS TO STACK, DUCTS, AND/OR FANS INCLUDED IN CAPITAL COST
N - TOTAL REGENERATION FACILITY COST INCLUDED IN CAPITAL COST
O - PARTIAL REGENERATION FACILITY COST INCLUDED IN CAPITAL COST
P - R & D COSTS INCLUDED IN CAPITAL COST
Q - COSTS UNDERWRITTEN BY SYSTEM SUPPLIER INCLUDED IN CAPITAL COST
R - EXCESS REAGENT SUPPLY COSTS INCLUDED IN CAPITAL COST

ANNUAL:

S - TOTAL DIRECT ANNUAL COSTS INCLUDED
T - PARTIAL DIRECT ANNUAL COSTS INCLUDED
U - TOTAL FIXED ANNUAL COSTS INCLUDED
V - PARTIAL FIXED ANNUAL COSTS INCLUDED
W - OVERHEAD COSTS INCLUDED IN TOTAL ANNUAL COSTS
X - PARTICULATE CONTROL COSTS INCLUDED IN DIRECT ANNUAL COSTS
Y - SLUDGE DISPOSAL SERVICE COSTS (CONTRACT) INCLUDED IN DIRECT ANNUAL COSTS
Z - REPLACEMENT ENERGY COSTS INCLUDED IN DIRECT ANNUAL COSTS

SECTION A-1 FGD SYSTEM ECONOMICS: OPERATIONAL SYSTEMS

REPORTED AND ADJUSTED COSTS

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                                         ELEMENTS                       TOTAL     ANNUAL - MILLS/KWH
UTILITY                                  INCLUDED IN       CAPACITY    CAPITAL   --------------------
STATION                                  CAPITAL AND        FACTOR      $/KW     TOTAL  DIRECT   FIXED
UNIT(S)                         FGD MW   ANNUAL COSTS         %        (YEAR)           (YEAR)
-------------------------    ---------   ------------      -------     ------    -----  ------   -----

KANSAS CITY POWER & LIGHT       110     B,D,F,T,X          *************** REPORTED ***************
HAWTHORN                                                       14        29.3     9.17
3                                                                       (1972)           (1977)
                                        B,C,E,J,K,S        *************** ADJUSTED ***************
                                        ,U,W,X                 65        87.3     4.35    2.93    1.42
                                                                        (1977)           (1977)

KANSAS CITY POWER & LIGHT       110     B,D,F,T,X          *************** REPORTED ***************
HAWTHORN                                                       14        29.3     9.17
4                                                                       (1972)           (1977)
                                        B,C,E,J,K,S        *************** ADJUSTED ***************
                                        ,U,W,X                 65        87.3     4.35    2.93    1.42
                                                                        (1977)           (1977)

KANSAS CITY POWER & LIGHT       874     B,C,E,J,S          *************** REPORTED ***************
LA CYGNE                                                       30        53.7     1.70    1.70
1                                                                       (1972)           (1977)
                                        C,E,J,K,S,U        *************** ADJUSTED ***************
                                                               65        68.0     3.78    1.70    2.08
                                                                        (1977)           (1977)

KENTUCKY UTILITIES               64     B,C,E,J,S,U        *************** REPORTED ***************
GREEN RIVER                             ,W                     16        70.3    14.35    5.06    9.29
1,2 & 3                                                                 (1975)           (1977)
                                        C,E,J,S,U,W        *************** ADJUSTED ***************
                                                               65        77.6     5.24    2.71    2.53
                                                                        (1977)           (1977)

LOUISVILLE GAS & ELECTRIC       190     C,E,H,J,Q,T        *************** REPORTED ***************
CANE RUN                                                       55        66.6     2.75
4                                                                       (1975)           (1977)
                                        C,E,H,J,K,Q        *************** ADJUSTED ***************
                                        ,S,U,W                 65        80.6     8.64    6.48    2.16
                                                                        (1977)           (1977)
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COST ELEMENTS

CAPITAL:

A - PARTICULATE CONTROL (REQUIRED FOR FGD PROCESS) INCLUDED IN CAPITAL COST
B - PARTICULATE CONTROL (INCLUDED IN FGD PROCESS) INCLUDED IN CAPITAL COST
C - TOTAL DIRECT CAPITAL COSTS INCLUDED
D - PARTIAL DIRECT CAPITAL COSTS INCLUDED
E - TOTAL INDIRECT CAPITAL COSTS INCLUDED
F - PARTIAL INDIRECT CAPITAL COSTS INCLUDED
G - CHEMICAL FIXATION OF SLUDGE INCLUDED IN CAPITAL COST
H - DRY SLUDGE DISPOSAL INCLUDED IN CAPITAL COST
I - OFF-SITE LANDFILL AREA INCLUDED IN CAPITAL COST
J - SLUDGE POND INCLUDED IN CAPITAL COST
K - ADDITONAL SLUDGE DISPOSAL CAPACITY ADDED FOR LIFE OF SYSTEM
L - STACK INCLUDED IN CAPITAL COST
M - MODIFICATIONS TO STACK, DUCTS, AND/OR FANS INCLUDED IN CAPITAL COST
N - TOTAL REGENERATION FACILITY COST INCLUDED IN CAPITAL COST
O - PARTIAL REGENERATION FACILITY COST INCLUDED IN CAPITAL COST
P - R & D COSTS INCLUDED IN CAPITAL COST
Q - COSTS UNDERWRITTEN BY SYSTEM SUPPLIER INCLUDED IN CAPITAL COST
R - EXCESS REAGENT SUPPLY COSTS INCLUDED IN CAPITAL COST

ANNUAL:

S - TOTAL DIRECT ANNUAL COSTS INCLUDED
T - PARTIAL DIRECT ANNUAL COSTS INCLUDED
U - TOTAL FIXED ANNUAL COSTS INCLUDED
V - PARTIAL FIXED ANNUAL COSTS INCLUDED
W - OVERHEAD COSTS INCLUDED IN TOTAL ANNUAL COSTS
X - PARTICULATE CONTROL COSTS INCLUDED IN DIRECT ANNUAL COSTS
Y - SLUDGE DISPOSAL SERVICE COSTS (CONTRACT) INCLUDED IN DIRECT ANNUAL COSTS
Z - REPLACEMENT ENERGY COSTS INCLUDED IN DIRECT ANNUAL COSTS

SECTION A-1 FGD SYSTEM ECONOMICS: OPERATIONAL SYSTEMS

REPORTED AND ADJUSTED COSTS

UTILITY STATION UNIT(S)	FGD MW	ELEMENTS INCLUDED IN CAPITAL AND ANNUAL COSTS	CAPACITY FACTOR %	TOTAL CAPITAL $/KW (YEAR)	ANNUAL - MILLS/KWH TOTAL	ANNUAL - MILLS/KWH DIRECT (YEAR)	ANNUAL - MILLS/KWH FIXED
LOUISVILLE GAS & ELECTRIC CANE RUN 5	200	C,F,H,J	**************** REPORTED ****************				
				62.4 (1977)			
		C,E,H,J,K,S ,U,W	**************** ADJUSTED ****************				
			65	67.5 (1977)	5.56	3.47 (1977)	2.09
LOUISVILLE GAS & ELECTRIC PADDYS RUN 6	70	C,E	**************** REPORTED ****************				
				52.9 (1973)			
		C,E,S,U,W	**************** ADJUSTED ****************				
			65	76.5 (1977)	6.51	3.92 (1977)	2.59
MINNKOTA POWER COOPERATIVE MILTON R. YOUNG 2	477	C,E,H,P	**************** REPORTED ****************				
				86.0 (1976)			
		C,E,H,M,P,S ,U,W	**************** ADJUSTED ****************				
			65	93.1 (1977)	5.55	2.24 (1977)	3.31
MONTANA POWER COLSTRIP 1	330	B,C,E,J,P,T	**************** REPORTED ****************				
			76	77.1 (1975)	.27	.27 (1977)	
		C,E,J,K,P,S ,U,W	**************** ADJUSTED ****************				
			65	77.3 (1977)	4.06	1.51 (1977)	2.55
MONTANA POWER COLSTRIP 2	330	B,C,E,J,P,T	**************** REPORTED ****************				
			76	77.1 (1975)	.27	.27 (1977)	
		C,E,J,K,P,S ,U,W	**************** ADJUSTED ****************				
			65	77.3 (1977)	4.06	1.51 (1977)	2.55

COST ELEMENTS

CAPITAL:

A - PARTICULATE CONTROL (REQUIRED FOR FGD PROCESS) INCLUDED IN CAPITAL COST
B - PARTICULATE CONTROL (INCLUDED IN FGD PROCESS) INCLUDED IN CAPITAL COST
C - TOTAL DIRECT CAPITAL COSTS INCLUDED
D - PARTIAL DIRECT CAPITAL COSTS INCLUDED
E - TOTAL INDIRECT CAPITAL COSTS INCLUDED
F - PARTIAL INDIRECT CAPITAL COSTS INCLUDED
G - CHEMICAL FIXATION OF SLUDGE INCLUDED IN CAPITAL COST
H - DRY SLUDGE DISPOSAL INCLUDED IN CAPITAL COST
I - OFF-SITE LANDFILL AREA INCLUDED IN CAPITAL COST
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O - PARTIAL REGENERATION FACILITY COST INCLUDED IN CAPITAL COST
P - R & D COSTS INCLUDED IN CAPITAL COST
Q - COSTS UNDERWRITTEN BY SYSTEM SUPPLIER INCLUDED IN CAPITAL COST
R - EXCESS REAGENT SUPPLY COSTS INCLUDED IN CAPITAL COST

ANNUAL:

S - TOTAL DIRECT ANNUAL COSTS INCLUDED
T - PARTIAL DIRECT ANNUAL COSTS INCLUDED
U - TOTAL FIXED ANNUAL COSTS INCLUDED
V - PARTIAL FIXED ANNUAL COSTS INCLUDED
W - OVERHEAD COSTS INCLUDED IN TOTAL ANNUAL COSTS
X - PARTICULATE CONTROL COSTS INCLUDED IN DIRECT ANNUAL COSTS
Y - SLUDGE DISPOSAL SERVICE COSTS (CONTRACT) INCLUDED IN DIRECT ANNUAL COSTS
Z - REPLACEMENT ENERGY COSTS INCLUDED IN DIRECT ANNUAL COSTS

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SECTION A-1 FGD SYSTEM ECONOMICS: OPERATIONAL SYSTEMS

REPORTED AND ADJUSTED COSTS

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                                            ELEMENTS                         TOTAL     ANNUAL - MILLS/KWH
UTILITY                                     INCLUDED IN      CAPACITY       CAPITAL   --------------------
STATION                                     CAPITAL AND       FACTOR         $/KW     TOTAL  DIRECT  FIXED
UNIT(S)                          FGD MW     ANNUAL COSTS        %           (YEAR)           (YEAR)
-------------------------      ---------    ------------      -------       ------    -----  ------  -----

NEVADA POWER                        125     B,D,F,P,S,U       *************** REPORTED ***************
REID GARDNER                                ,W,X                 67          42.9     2.10    1.30     .80
1                                                                           (1973)           (1977)
                                            B,C,E,J,P,S       *************** ADJUSTED ***************
                                            ,U,W,X               65          60.9     3.20    1.30    1.90
                                                                            (1977)           (1977)

NEVADA POWER                        125     B,D,E,F,S,U       *************** REPORTED ***************
REID GARDNER                                ,W,X                 67          42.9     2.10    1.30     .80
2                                                                           (1973)           (1977)
                                            B,C,E,J,P,S       *************** ADJUSTED ***************
                                            ,U,W,X               65          60.9     3.20    1.30    1.90
                                                                            (1977)           (1977)

NEVADA POWER                        125     B,C,E,L,S,U       *************** REPORTED ***************
REID GARDNER                                ,W,X                 67         113.6     2.10    1.30     .80
3                                                                           (1975)           (1977)
                                            C,E,S,U,W,X       *************** ADJUSTED ***************
                                                                 65         107.9     4.38    1.30    3.08
                                                                            (1977)           (1977)

NORTHERN INDIANA PUB SERVICE         92                       *************** REPORTED ***************
DEAN H. MITCHELL
11

                                                              *************** ADJUSTED ***************


NORTHERN STATES POWER               720     B,C,G,J,S,U       *************** REPORTED ***************
SHERBURNE                                   ,X,Z                 73          49.3     1.98    1.05     .93
1                                                                           (1972)           (1977)
                                            C,F,G,J,K,S       *************** ADJUSTED ***************
                                            ,U,W                 65          71.5     2.77     .75    2.02
                                                                            (1977)           (1977)
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COST ELEMENTS

CAPITAL:

A - PARTICULATE CONTROL (REQUIRED FOR FGD PROCESS) INCLUDED IN CAPITAL COST
B - PARTICULATE CONTROL (INCLUDED IN FGD PROCESS) INCLUDED IN CAPITAL COST
C - TOTAL DIRECT CAPITAL COSTS INCLUDED
D - PARTIAL DIRECT CAPITAL COSTS INCLUDED
E - TOTAL INDIRECT CAPITAL COSTS INCLUDED
F - PARTIAL INDIRECT CAPITAL COSTS INCLUDED
G - CHEMICAL FIXATION OF SLUDGE INCLUDED IN CAPITAL COST
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L - STACK INCLUDED IN CAPITAL COST
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O - PARTIAL REGENERATION FACILITY COST INCLUDED IN CAPITAL COST
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R - EXCESS REAGENT SUPPLY COSTS INCLUDED IN CAPITAL COST

ANNUAL:

S - TOTAL DIRECT ANNUAL COSTS INCLUDED
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V - PARTIAL FIXED ANNUAL COSTS INCLUDED
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X - PARTICULATE CONTROL COSTS INCLUDED IN DIRECT ANNUAL COSTS
Y - SLUDGE DISPOSAL SERVICE COSTS (CONTRACT) INCLUDED IN DIRECT ANNUAL COSTS
Z - REPLACEMENT ENERGY COSTS INCLUDED IN DIRECT ANNUAL COSTS

SECTION A-1 FGD SYSTEM ECONOMICS: OPERATIONAL SYSTEMS

REPORTED AND ADJUSTED COSTS

UTILITY STATION UNIT(S)	FGD MW	ELEMENTS INCLUDED IN CAPITAL AND ANNUAL COSTS	CAPACITY FACTOR %	TOTAL CAPITAL $/KW (YEAR)	ANNUAL - MILLS/KWH TOTAL	ANNUAL - MILLS/KWH DIRECT (YEAR)	ANNUAL - MILLS/KWH FIXED
NORTHERN STATES POWER SHERBURNE 2	720	B,C,G,J,S,U,X,Z	*************** REPORTED ***************				
			73	49.3 (1972)	1.98	1.05 (1977)	.93
		C,E,G,J,K,S,U,W	*************** ADJUSTED ***************				
			65	71.5 (1977)	2.77	.75 (1977)	2.02
PENNSYLVANIA POWER BRUCE MANSFIELD 1	917	B,C,E,G,I,L,S,U,W,X	*************** REPORTED ***************				
			40	120.7 (1975)	13.18	4.08 (1977)	9.10
		C,E,G,I,M,S,U,W	*************** ADJUSTED ***************				
			65	102.2 (1977)	7.67	4.50 (1977)	3.17
PENNSYLVANIA POWER BRUCE MANSFIELD 2	917	B,C,E,G,I,L,S,U,W,X	*************** REPORTED ***************				
			40	120.7 (1975)	13.18	4.08 (1977)	9.10
		C,E,G,I,M,S,U,W	*************** ADJUSTED ***************				
			65	102.2 (1977)	7.67	4.50 (1977)	3.17
PHILADELPHIA ELECTRIC EDDYSTONE 1A	105	D,F,N,P	*************** REPORTED ***************				
				156.8 (1972)			
		C,E,N,P	*************** ADJUSTED ***************				
				233.3 (1977)			
PUBLIC SERVICE OF NEW MEXICO SAN JUAN 1	357	A,C,F,N	*************** REPORTED ***************				
				127.9 (1977)			
			*************** ADJUSTED ***************				

COST ELEMENTS

CAPITAL:

- A - PARTICULATE CONTROL (REQUIRED FOR FGD PROCESS) INCLUDED IN CAPITAL COST
- B - PARTICULATE CONTROL (INCLUDED IN FGD PROCESS) INCLUDED IN CAPITAL COST
- C - TOTAL DIRECT CAPITAL COSTS INCLUDED
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- E - TOTAL INDIRECT CAPITAL COSTS INCLUDED
- F - PARTIAL INDIRECT CAPITAL COSTS INCLUDED
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ANNUAL:

- S - TOTAL DIRECT ANNUAL COSTS INCLUDED
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- X - PARTICULATE CONTROL COSTS INCLUDED IN DIRECT ANNUAL COSTS
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- Z - REPLACEMENT ENERGY COSTS INCLUDED IN DIRECT ANNUAL COSTS

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                          SECTION A-1  FGD SYSTEM ECONOMICS: OPERATIONAL SYSTEMS

                                        REPORTED AND ADJUSTED COSTS

UTILITY                                      ELEMENTS                        TOTAL     ANNUAL - MILLS/KWH
STATION                                      INCLUDED IN       CAPACITY      CAPITAL   ---------------------
UNIT(S)                           FGD MW     CAPITAL AND       FACTOR        $/KW      TOTAL  DIRECT  FIXED
                                             ANNUAL COSTS      %             (YEAR)           (YEAR)
--------------------------       ---------   ------------      -------       ------    -----  ------  -----

SOUTH CAROLINA PUBLIC SERVICE       140      C,F,J,M,S,V       *************** REPORTED ***************
WINYAH                                                            80         47.5      1.61    .88     .73
2                                                                            (1976)           (1977)
                                             C,E,J,K,M,S       *************** ADJUSTED ***************
                                             ,U,W                 65         66.5      2.92   1.04    1.88
                                                                             (1977)           (1977)

SPRINGFIELD CITY UTILITIES          194      C,F,H,J,P         *************** REPORTED ***************
SOUTHWEST                                                                    77.3
1                                                                            (1974)
                                             C,E,H,J,K,P       *************** ADJUSTED ***************
                                             ,S,U,W               65         117.7     6.17   2.87    3.30
                                                                             (1977)           (1977)

TENNESSEE VALLEY AUTHORITY          550      A,C,E,P,R,T       *************** REPORTED ***************
WIDOWS CREEK                                 ,U                   60         98.2      2.94
8                                                                            (1976)           (1977)
                                             C,F,J,S,U,W       *************** ADJUSTED ***************
                                                                  65         115.2     5.28   1.44    3.84
                                                                             (1977)           (1977)

TEXAS UTILITTES                     750                        *************** REPORTED ***************
MONTICELLO                                                                   25.0
3                                                                            (1978)
                                                               *************** ADJUSTED ***************
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COST ELEMENTS

CAPITAL:

A - PARTICULATE CONTROL (REQUIRED FOR FGD PROCESS) INCLUDED IN CAPITAL COST
B - PARTICULATE CONTROL (INCLUDED IN FGD PROCESS) INCLUDED IN CAPITAL COST
C - TOTAL DIRECT CAPITAL COSTS INCLUDED
D - PARTIAL DIRECT CAPITAL COSTS INCLUDED
E - TOTAL INDIRECT CAPITAL COSTS INCLUDED
F - PARTIAL INDIRECT CAPITAL COSTS INCLUDED
G - CHEMICAL FIXATION OF SLUDGE INCLUDED IN CAPITAL COST
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SECTION A-2 FGD SYSTEM ECONOMICS: NONOPERATIONAL SYSTEMS

REPORTED AND ADJUSTED COSTS

UTILITY STATION UNIT(S)	FGD MW	ELEMENTS INCLUDED IN CAPITAL AND ANNUAL COSTS	CAPACITY FACTOR %	TOTAL CAPITAL $/KW (YEAR)	ANNUAL - MILLS/KWH		
					TOTAL	DIRECT (YEAR)	FIXED
ALABAMA ELECTRIC COOP TOMBIGBEE 2	255	C,E,J	***************	REPORTED	***************		
				69.5 (1978)			
ALABAMA ELECTRIC COOP TOMBIGBEE 3	255	C,E,J	***************	REPORTED	***************		
				69.5 (1978)			
ARIZONA ELECTRIC POWER COOP APACHE 2	200	B,C	***************	REPORTED	***************		
				5.3 (1978)			
ARIZONA ELECTRIC POWER COOP APACHE 3	200	B,C	***************	REPORTED	***************		
				5.3 (1978)			
BASIN ELECTRIC POWER COOP LARAMIE RIVER 1	550	C,E	***************	REPORTED	***************		
				68.2 (1980)			
BASIN ELECTRIC POWER COOP LARAMIE RIVER 2	550	C,E	***************	REPORTED	***************		
				68.2 (1980)			
BIG RIVERS ELECTRIC REID 2	250	B,C	***************	REPORTED	***************		
				43.2 (1976)			
BOSTON EDISON MYSTIC 6	155	B,C,E,N,O	***************	REPORTED	***************		
				63.4 (1972)	3.00	(1976)	

COST ELEMENTS

CAPITAL:

A - PARTICULATE CONTROL (REQUIRED FOR FGD PROCESS) INCLUDED IN CAPITAL COST
B - PARTICULATE CONTROL (INCLUDED IN FGD PROCESS) INCLUDED IN CAPITAL COST
C - TOTAL DIRECT CAPITAL COSTS INCLUDED
D - PARTIAL DIRECT CAPITAL COSTS INCLUDED
E - TOTAL INDIRECT CAPITAL COSTS INCLUDED
F - PARITAL INDIRECT CAPITAL COSTS INCLUDED
G - CHEMICAL FIXATION OF SLUDGE INCLUDED IN CAPITAL COST
H - DRY SLUDGE DISPOSAL INCLUDED IN CAPITAL COST
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Y - SLUDGE DISPOSAL SERVICE COSTS (CONTRACT) INCLUDED IN DIRECT ANNUAL COSTS
Z - REPLACEMENT ENERGY COSTS INCLUDED IN DIRECT ANNUAL COSTS

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                       SECTION A-2  FGD SYSTEM ECONOMICS: NONOPERATIONAL SYSTEMS

                                    REPORTED AND ADJUSTED COSTS

                                         ELEMENTS                        TOTAL      ANNUAL - MILLS/KWH
UTILITY                                  INCLUDED IN       CAPACITY     CAPITAL   ---------------------
STATION                                  CAPITAL AND       FACTOR       $/KW      TOTAL  DIRECT   FIXED
UNIT(S)                        FGD MW    ANNUAL COSTS      %            (YEAR)           (YEAR)
-------------------------    ---------   ------------     -------      ------    -----  ------   -----

UTAH POWER & LIGHT               400     C,F,J,M           *************** REPORTED ***************
EMERY                                                                  95.3     5.31
2                                                                      (1978)           (1976)


CENTRAL ILLINOIS PUBLIC SERV     575     C,F,G             *************** REPORTED ***************
NEWTON                                                                 189.0
1                                                                      (1979)


COLORADO UTE ELECTRIC ASSN.      450     B,D,F             *************** REPORTED ***************
CRAIG                                                                  117.0
1                                                                      (1979)


COLORADO UTE ELECTRIC ASSN.      450     A,C               *************** REPORTED ***************
CRAIG                                                                  117.0
2                                                                      (1979)


COMMONWEALTH EDISON              425     C,E,H,J           *************** REPORTED ***************
POWERTON                                                               117.7
51                                                                     (1979)


COMMONWEALTH EDISON              167     B,C,E,G,J,X       *************** REPORTED ***************
WILL COUNTY                                                    49      115.0    13.06
1                                                                      (1972)           (1975)


DETROIT EDISON                   163     B,C,F,J,M,X       *************** REPORTED ***************
ST. CLAIR                                                              80.3     9.60
6                                                                      (1976)           (1976)


ILLINOIS POWER                   110     A,C,E,M,N         *************** REPORTED ***************
WOOD RIVER                                                             82.5
4                                                                      (1972)

                                         COST ELEMENTS
    CAPITAL:
         A - PARTICULATE CONTROL (REQUIRED FOR FGD PROCESS) INCLUDED IN CAPITAL COST
         B - PARTICULATE CONTROL (INCLUDED IN FGD PROCESS) INCLUDED IN CAPITAL COST
         C - TOTAL DIRECT CAPITAL COSTS INCLUDED
         D - PARTIAL DIRECT CAPITAL COSTS INCLUDED
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         Q - COSTS UNDERWRITTEN BY SYSTEM SUPPLIER INCLUDED IN CAPITAL COST
         R - EXCESS REAGENT SUPPLY COSTS INCLUDED IN CAPITAL COST

    ANNUAL:
         S - TOTAL DIRECT ANNUAL COSTS INCLUDED
         T - PARTIAL DIRECT ANNUAL COSTS INCLUDED
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         V - PARTIAL FIXED ANNUAL COSTS INCLUDED
         W - OVERHEAD COSTS INCLUDED IN TOTAL ANNUAL COSTS
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         Y - SLUDGE DISPOSAL SERVICE COSTS (CONTRACT) INCLUDED IN DIRECT ANNUAL COSTS
         Z - REPLACEMENT ENERGY COSTS INCLUDED IN DIRECT ANNUAL COSTS
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EPA UTILITY FGD SURVEY: APRIL 1978 - MAY 1978

                    SECTION A-2  FGD SYSTEM ECONOMICS: NONOPERATIONAL SYSTEMS

                                   REPORTED AND ADJUSTED COSTS

                                        ELEMENTS                            TOTAL     ANNUAL - MILLS/KWH
                                        INCLUDED IN          CAPACITY      CAPITAL   --------------------
UTILITY                                 CAPITAL AND          FACTOR        $/KW      TOTAL  DIRECT   FIXED
STATION                                 ANNUAL COSTS            %          (YEAR)           (YEAR)
UNIT(S)                      FGD MW
-------------------------   ---------   ------------         -------      ------    -----  ------   -----

LOUISVILLE GAS & ELECTRIC       277     C,E,J,M              *************** REPORTED ***************
CANE RUN                                                                   58.9
6                                                                         (1979)

PACIFIC POWER & LIGHT           509     C,E,J                *************** REPORTED ***************
JIM BRIDGER                                                                120.0
4                                                                         (1979)

POTOMAC ELECTRIC POWER          190     A,C,E,M              *************** REPORTED ***************
DICKERSON                                                                  68.0
3                                                                         (1973)

PUBLIC SERVICE OF COLORADO       50     B,C,E,J              *************** REPORTED ***************
VALMONT                                                                    87.0
5                                                                         (1974)

PUBLIC SERVICE OF NEW MEXICO    357     A,C,E,N              *************** REPORTED ***************
SAN JUAN                                                                   127.9
2                                                                         (1977)

SALT RIVER PROJECT              350     C,E                  *************** REPORTED ***************
CORONADO                                                                   98.0
1                                                                         (1978)

SALT RIVER PROJECT              350     C,E                  *************** REPORTED ***************
CORONADO                                                                   98.0
2                                                                         (1978)

SOUTHERN INDIANA GAS & ELEC     250     C,E,G                *************** REPORTED ***************
A. B. BROWN                                                                43.2
1                                                                         (1979)

                                       COST ELEMENTS
     CAPITAL:
          A - PARTICULATE CONTROL (REQUIRED FOR FGD PROCESS) INCLUDED IN CAPITAL COST
          B - PARTICULATE CONTROL (INCLUDED IN FGD PROCESS) INCLUDED IN CAPITAL COST
          C - TOTAL DIRECT CAPITAL COSTS INCLUDED
          D - PARTIAL DIRECT CAPITAL COSTS INCLUDED
          E - TOTAL INDIRECT CAPITAL COSTS INCLUDED
          F - PARITAL INDIRECT CAPITAL COSTS INCLUDED
          G - CHEMICAL FIXATION OF SLUDGE INCLUDED IN CAPITAL COST
          H - DRY SLUDGE DISPOSAL INCLUDED IN CAPITAL COST
          I - OFF-SITE LANDFILL AREA INCLUDED IN CAPITAL COST
          J - SLUDGE POND INCLUDED IN CAPITAL COST
          K - ADDITONAL SLUDGE DISPOSAL CAPACITY ADDED FOR LIFE OF SYSTEM
          L - STACK INCLUDED IN CAPITAL COST
          M - MODIFICATIONS TO STACK, DUCTS, AND/OR FANS INCLUDED IN CAPITAL COST
          N - TOTAL REGENERATION FACILITY COST INCLUDED IN CAPITAL COST
          O - PARTIAL REGENERATION FACILITY COST INCLUDED IN CAPITAL COST
          P - R & D COSTS INCLUDED IN CAPITAL COST
          Q - COSTS UNDERWRITTEN BY SYSTEM SUPPLIER INCLUDED IN CAPITAL COST
          R - EXCESS REAGENT SUPPLY COSTS INCLUDED IN CAPITAL COST

     ANNUAL:
          S - TOTAL DIRECT ANNUAL COSTS INCLUDED
          T - PARTIAL DIRECT ANNUAL COSTS INCLUDED
          U - TOTAL FIXED ANNUAL COSTS INCLUDED
          V - PARTIAL FIXED ANNUAL COSTS INCLUDED
          W - OVERHEAD COSTS INCLUDED IN TOTAL ANNUAL COSTS
          X - PARTICULATE CONTROL COSTS INCLUDED IN DIRECT ANNUAL COSTS
          Y - SLUDGE DISPOSAL SERVICE COSTS (CONTRACT) INCLUDED IN DIRECT ANNUAL COSTS
          Z - REPLACEMENT ENERGY COSTS INCLUDED IN DIRECT ANNUAL COSTS
```

SECTION A-2 FGD SYSTEM ECONOMICS: NONOPERATIONAL SYSTEMS

REPORTED AND ADJUSTED COSTS

UTILITY STATION UNIT(S)	FGD MW	ELEMENTS INCLUDED IN CAPITAL AND ANNUAL COSTS	CAPACITY FACTOR %	TOTAL CAPITAL $/KW (YEAR)	ANNUAL - MILLS/KWH TOTAL	DIRECT (YEAR)	FIXED
SOUTHERN MISSISSIPPI ELECTRIC	180	C,E	***************	REPORTED	***************		
R. D. MORROW 1				37.4 (1975)			
SOUTHERN MISSISSIPPI ELECTRIC	180	C,E	***************	REPORTED	***************		
R. D. MORROW 2				37.4 (1975)			
WISCONSIN POWER & LIGHT	527		***************	REPORTED	***************		
COLUMBIA 2				57.0 (1980)			

COST ELEMENTS

CAPITAL:

A - PARTICULATE CONTROL (REQUIRED FOR FGD PROCESS) INCLUDED IN CAPITAL COST
B - PARTICULATE CONTROL (INCLUDED IN FGD PROCESS) INCLUDED IN CAPITAL COST
C - TOTAL DIRECT CAPITAL COSTS INCLUDED
D - PARTIAL DIRECT CAPITAL COSTS INCLUDED
E - TOTAL INDIRECT CAPITAL COSTS INCLUDED
F - PARITAL INDIRECT CAPITAL COSTS INCLUDED
G - CHEMICAL FIXATION OF SLUDGE INCLUDED IN CAPITAL COST
H - DRY SLUDGE DISPOSAL INCLUDED IN CAPITAL COST
I - OFF-SITE LANDFILL AREA INCLUDED IN CAPITAL COST
J - SLUDGE POND INCLUDED IN CAPITAL COST
K - ADDITONAL SLUDGE DISPOSAL CAPACITY ADDED FOR LIFE OF SYSTEM
L - STACK INCLUDED IN CAPITAL COST
M - MODIFICATIONS TO STACK, DUCTS, AND/OR FANS INCLUDED IN CAPITAL COST
N - TOTAL REGENERATION FACILITY COST INCLUDED IN CAPITAL COST
O - PARTIAL REGENERATION FACILITY COST INCLUDED IN CAPITAL COST
P - R & D COSTS INCLUDED IN CAPITAL COST
Q - COSTS UNDERWRITTEN BY SYSTEM SUPPLIER INCLUDED IN CAPITAL COST
R - EXCESS REAGENT SUPPLY COSTS INCLUDED IN CAPITAL COST

ANNUAL:

S - TOTAL DIRECT ANNUAL COSTS INCLUDED
T - PARTIAL DIRECT ANNUAL COSTS INCLUDED
U - TOTAL FIXED ANNUAL COSTS INCLUDED
V - PARTIAL FIXED ANNUAL COSTS INCLUDED
W - OVERHEAD COSTS INCLUDED IN TOTAL ANNUAL COSTS
X - PARTICULATE CONTROL COSTS INCLUDED IN DIRECT ANNUAL COSTS
Y - SLUDGE DISPOSAL SERVICE COSTS (CONTRACT) INCLUDED IN DIRECT ANNUAL COSTS
Z - REPLACEMENT ENERGY COSTS INCLUDED IN DIRECT ANNUAL COSTS

APPENDIX B

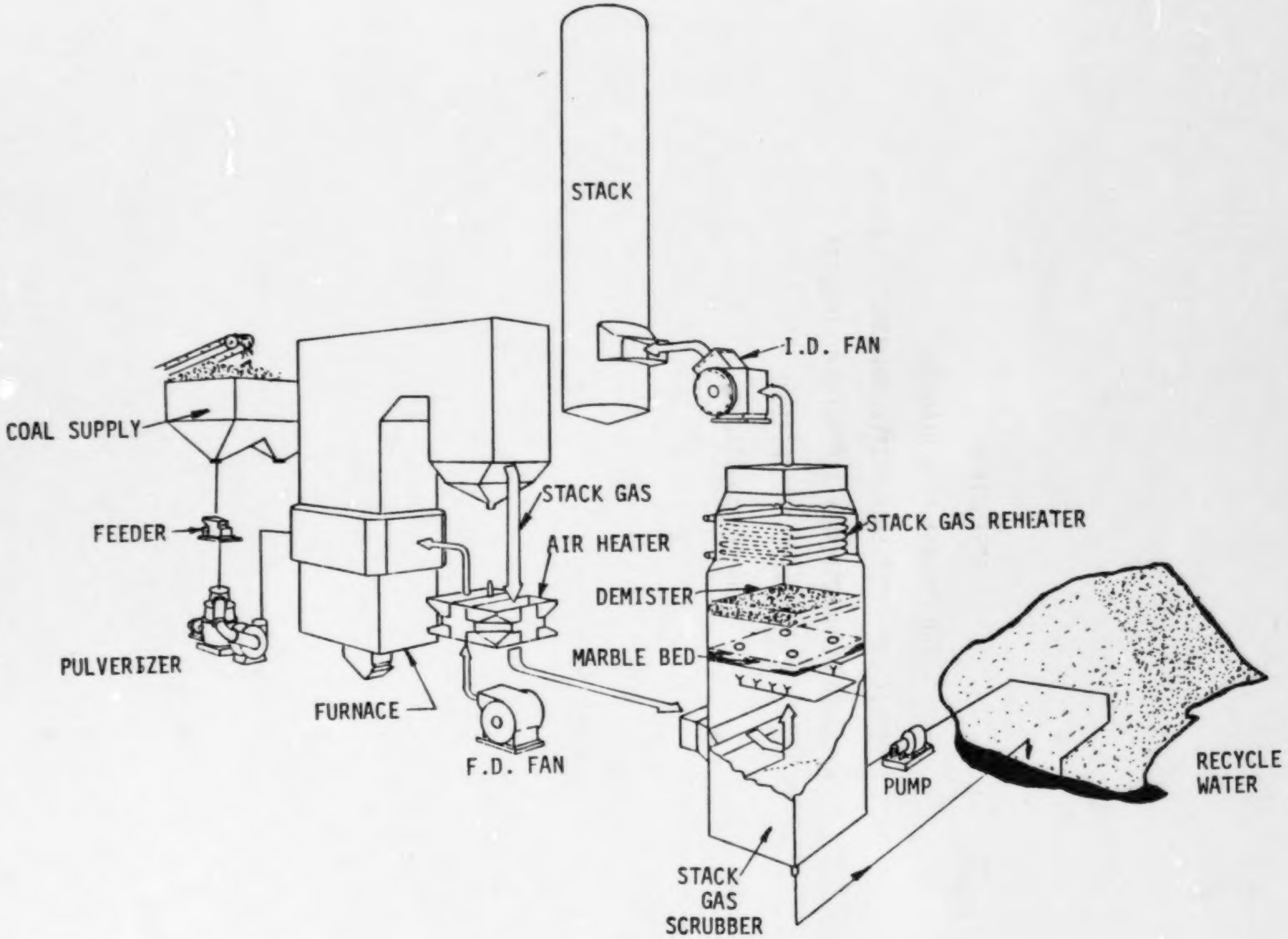
FGD PROCESS FLOW DIAGRAMS

THIS APPENDIX COMPRISES BOTH ACTIVE AND INACTIVE UNITS

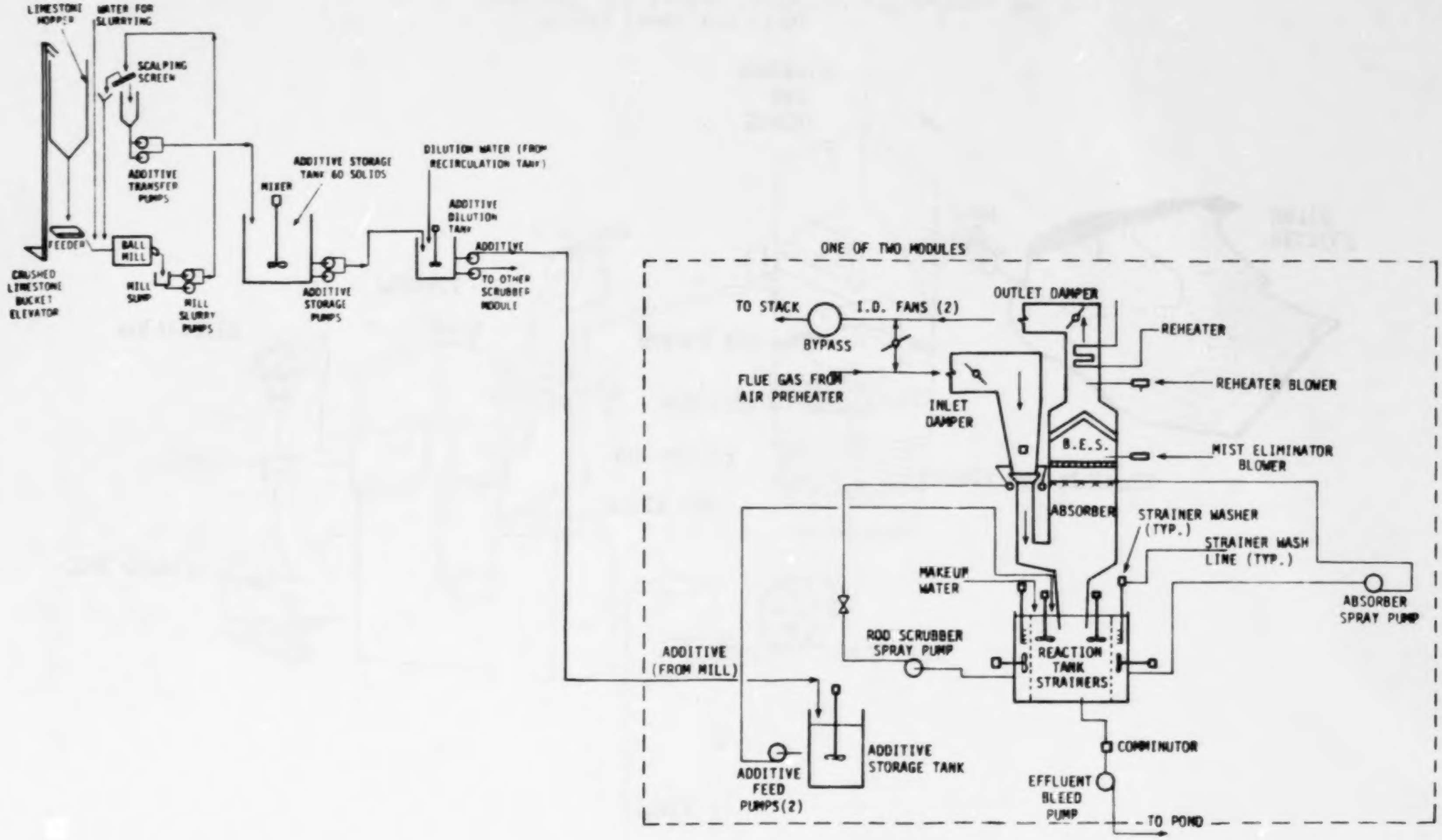
ARRANGED ALPHABETICALLY ACCORDING TO UTILITY

"SUPPLEMENTAL EDITION"

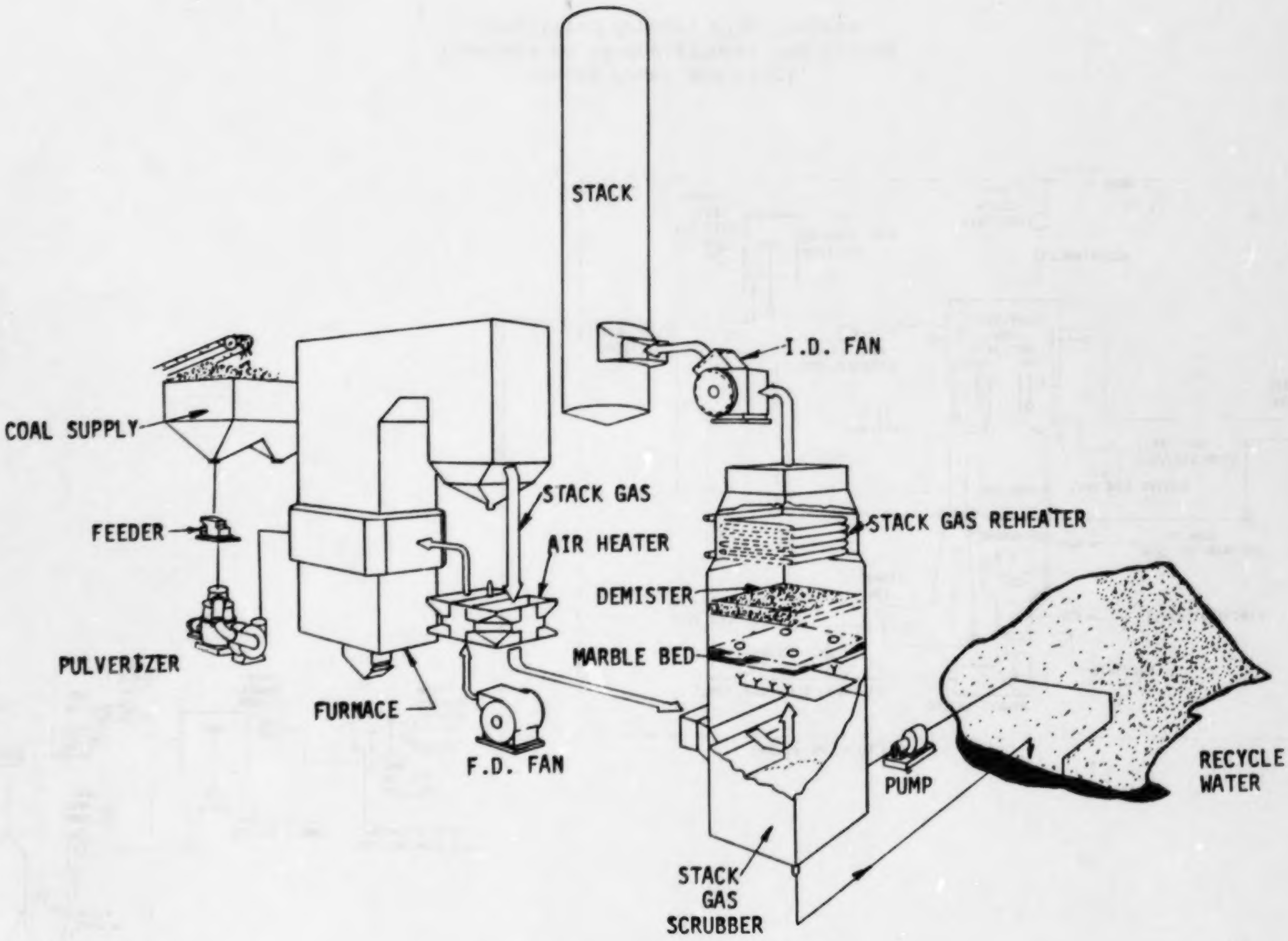
CHANGES/ADDITIONS


STACK
I.D. FAN
COAL SUPPLY
STACK GAS
STACK GAS REHEATER
FEEDER
AIR HEATER
DEMISTER
PULVERIZER
MARBLE BED
FURNACE
F.D. FAN
PUMP
RECYCLE WATER
STACK GAS SCRUBBER

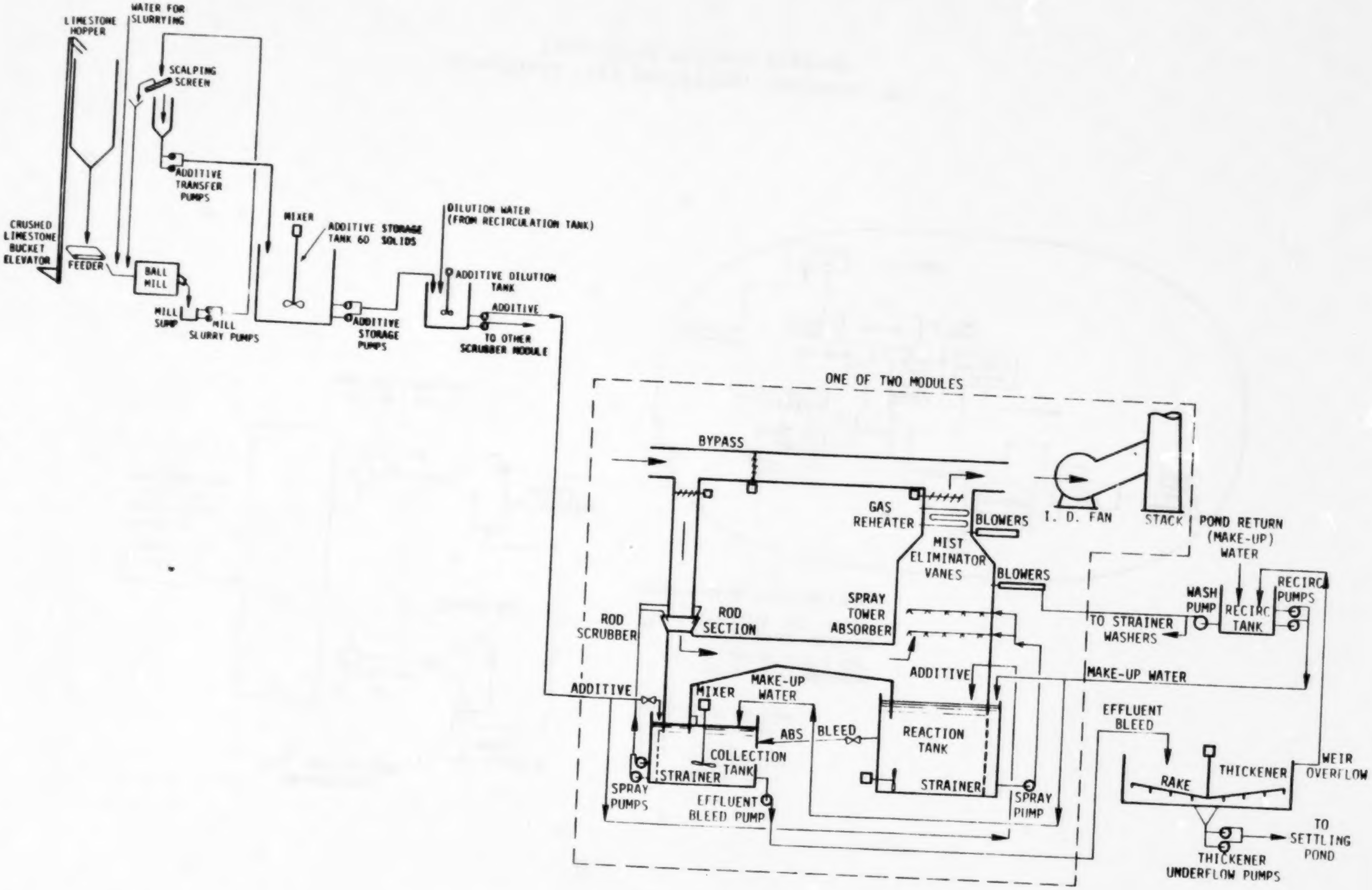
Kansas Power and Light
Original Operational FGD System at Lawrence No. 4.


LIMESTONE HOPPER
WATER FOR SLURRYING
SCALPING SCREEN
ADDITIVE TRANSFER PUMPS
CRUSHED LIMESTONE BUCKET ELEVATOR
FEEDER
BALL MILL
MILL SUMP
MILL SLURRY PUMPS
MIXER
ADDITIVE STORAGE TANK 60 SOLIDS
ADDITIVE STORAGE PUMPS
DILUTION WATER (FROM RECIRCULATION TANK)
ADDITIVE DILUTION TANK
ADDITIVE
TO OTHER SCRUBBER MODULE
ONE OF TWO MODULES
TO STACK
BYPASS
I.D. FANS (2)
OUTLET DAMPER
REHEATER
REHEATER BLOWER
FLUE GAS FROM AIR PREHEATER
INLET DAMPER
B.E.S.
MIST ELIMINATOR BLOWER
ABSORBER
STRAINER WASHER (TYP.)
STRAINER WASH LINE (TYP.)
MAKEUP WATER
ABSORBER SPRAY PUMP
ROD SCRUBBER SPRAY PUMP
REACTION TANK STRAINERS
ADDITIVE (FROM MILL)
ADDITIVE FEED PUMPS(2)
ADDITIVE STORAGE TANK
COMMINUTOR
EFFLUENT BLEED PUMP
TO POND

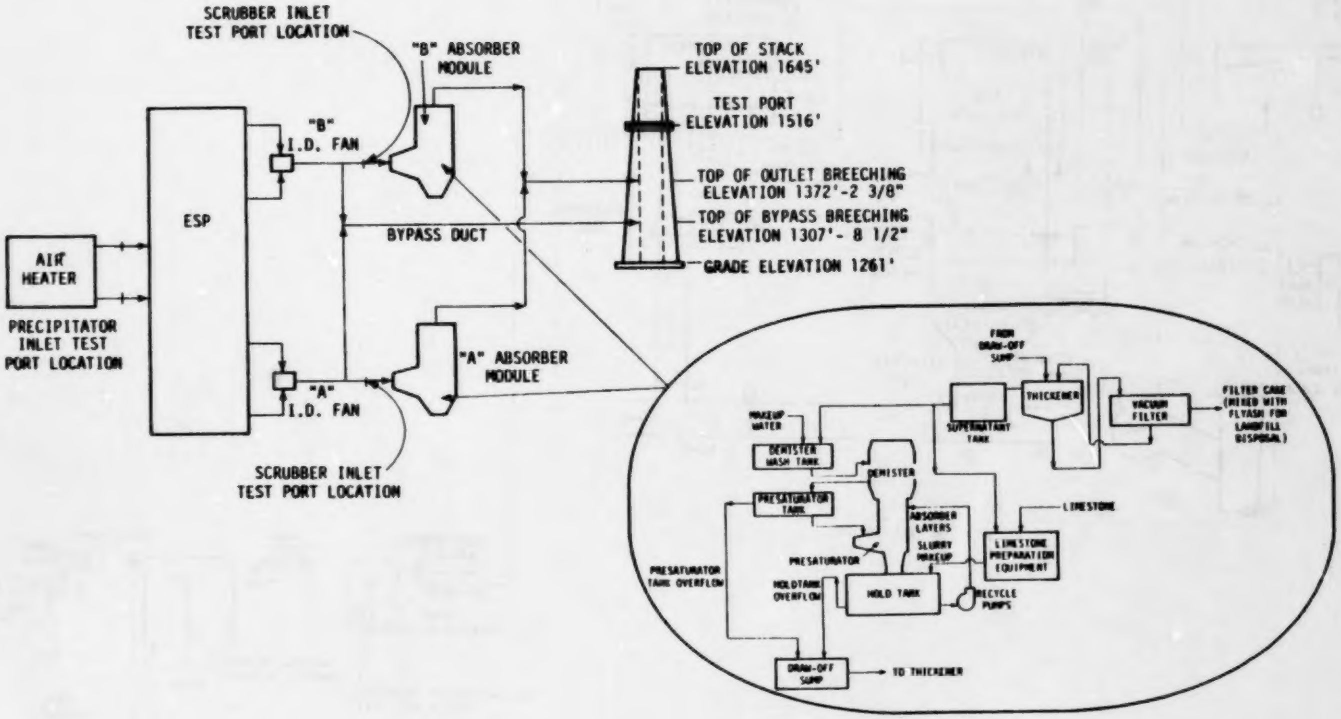
Kansas Power and Light,
Lawrence No. 4 Operational FGD System
Simplified Process Flow Diagram.


STACK
I.D. FAN
COAL SUPPLY
STACK GAS
STACK GAS REHEATER
FEEDER
AIR HEATER
DEMISTER
MARBLE BED
PULVERIZER
FURNACE
F.D. FAN
RECYCLE WATER
PUMP
STACK GAS SCRUBBER

Kansas Power and Light
Original FGD System Installed at Lawrence No. 5:
Simplified Process Flow Diagram.


LIMESTONE HOPPER
WATER FOR SLURRYING
SCALPING SCREEN
ADDITIVE TRANSFER PUMPS
CRUSHED LIMESTONE BUCKET ELEVATOR
FEEDER
BALL MILL
MILL SUMP
MILL SLURRY PUMPS
MIXER
ADDITIVE STORAGE TANK 60 SOLIDS
ADDITIVE STORAGE PUMPS
DILUTION WATER (FROM RECIRCULATION TANK)
ADDITIVE DILUTION TANK
ADDITIVE
TO OTHER SCRUBBER MODULE
ONE OF TWO MODULES
BYPASS
GAS REHEATER
BLOWERS
I. D. FAN
STACK
POND RETURN (MAKE-UP) WATER
MIST ELIMINATOR VANES
BLOWERS
SPRAY TOWER ABSORBER
ROD SCRUBBER
ROD SECTION
WASH PUMP
RECIRC TANK
RECIRC PUMPS
TO STRAINER WASHERS
ADDITIVE
MAKE-UP WATER
ADDITIVE
MIXER
MAKE-UP WATER
ABS
BLEED
COLLECTION TANK
STRAINER
REACTION TANK
STRAINER
SPRAY PUMPS
EFFLUENT BLEED PUMP
SPRAY PUMP
EFFLUENT BLEED
RAKE
THICKENER
WEIR OVERFLOW
TO SETTLING POND
THICKENER UNDERFLOW PUMPS

Kansas Power and Light,
Lawrence No. 5 Operational FGD System
Simplified Process Flow Diagram


SCRUBBER INLET
TEST PORT LOCATION
"B" ABSORBER
MODULE
TOP OF STACK
ELEVATION 1645'
TEST PORT
ELEVATION 1516'
"B"
I.D. FAN
ESP
AIR HEATER
TOP OF OUTLET BREECHING
ELEVATION 1372'-2 3/8"
TOP OF BYPASS BREECHING
ELEVATION 1307'- 8 1/2"
BYPASS DUCT
GRADE ELEVATION 1261'
PRECIPITATOR
INLET TEST
PORT LOCATION
"A" ABSORBER
MODULE
"A"
I.D. FAN
SCRUBBER INLET
TEST PORT LOCATION
FROM
DRAW-OFF
SUMP
THICKENER
VACUUM
FILTER
FILTER CAKE
(MIXED WITH
FLYASH FOR
LANDFILL
DISPOSAL)
MAKEUP
WATER
SUPERNATANT
TANK
DEMISTER
WASH TANK
DEMISTER
PRESATURATOR
TANK
LIMESTONE
ABSORBER
LAYERS
SLURRY
MAKEUP
LIMESTONE
PREPARATION
EQUIPMENT
PRESATURATOR
PRESATURATOR
TANK OVERFLOW
HOLDTANK
OVERFLOW
HOLD TANK
RECYCLE
PUMPS
DRAW-OFF
SUMP
TO THICKENER

Springfield City Utilities, Southwest No. 1:
Simplified Process Diagram

APPENDIX C

DEFINITIONS

DEFINITIONS

Boiler Capacity Factor:	(kWh generation in year)/maximum continuous generating capacity in kW x 8760 hr/yr).
Boiler Utilization Parameter:	Hours boiler operated/hours in period, expressed as a percentage.
Efficiency:	
Particulates	The actual percentage of particulates removed by the emission control system (mechanical collectors, ESP, or fabric filter and FGD) from the untreated flue gas.
SO_2	The actual percentage of SO_2 removed from the flue gas by the FGD system. Design removal efficiency values are presented for nonoperational systems for which actual removal data are not available.
FGD Viability Indexes	Several parameters have been developed to quantify the viability of FGD system technology. Various terms such as "availability," "reliability," "operability," and "utilization" are used to accurately represent the operation of any FGD system during a given period. The above-mentioned parameters are defined below and discussed briefly. The objectives of this discussion are to make the reader aware that several different definitions are being used and to select appropriate parameters that can be used for reporting purposes so that reasonably consistent comparisons can be made.

DEFINITIONS

Availability Index	Hours the FGD system is available for operation (whether operated or not) divided by hours in period, expressed as a percentage. This parameter tends to overestimate the viability of the FGD system because it does not penalize for election not to operate the system when it could have been operated. Boiler downtime may tend to increase the magnitude of the parameter because FGD failures generally cannot occur during such periods.
Reliability Index	Hours the FGD system was operated divided by the hours the FGD system was called upon to operate, expressed as a percentage. This parameter has been developed in order not to penalize the FGD system for elected outages, e.g., periods when the FGD system could have been run but was not run because of chemical shortages, lack of manpower, short duration boiler operations, etc. The main problem in using this formula is the concise determination whether or not the system was "called upon to operate" during a given time period. In addition, an undefined value can result when the FGD system is not called upon to operate for a given period (e.g., turbine or boiler outage when FGD system is available).
FGD Operability Index	Hours the FGD system was operated divided by boiler operating hours in period, expressed as a percentage. This parameter indicates the degree to which the FGD system is actually used, relative to boiler

	operating time. The parameter does not reflect the extent of exertion on the FGD system, that is, the magnitude of the parameter has little or no correlation with FGD system operating time. Also, the parameter is penalized when options are exercised not to use the FGD system in periods when the system is operable. In addition, an undefined value can result when the FGD system is not called upon to operate for a given period (e.g., turbine or boiler outage when FGD system is available).
FGD Utilization Index	Hours that the FGD system operated divided by total hours in period. This parameter is a relative stress factor for the FGD system. It is not a complete measure of FGD system viability because the parameter can be strongly influenced by conditions that are external to the FGD system (e.g., infrequent boiler operation will lower the value of the parameter although the FGD system may be highly dependable in its particular application).
FGD Status:	
Category 1	Operational - FGD system is in service removing SO_2.
Category 2	Under Construction - ground has been broken for installation of FGD system, but FGD system has not become operational.
Category 3	Planned, Contract Awarded - contract has been signed for purchase of FGD system but ground has not been broken for installation.

Category 4	Planned, Letter of Intent Signed - letter of intent has been signed, but legal contract for purchase has not been awarded.
Category 5	Planned, Requesting/Evaluating Bids - bid requests have been released but no letter of intent or contract has been issued.
Category 6	Considering only FGD Systems - an FGD system is proposed as a means to meet an SO_2 regulation.
Category 7	Considering an FGD system as well as alternative methods.
Category 8	Nonoperational - FGD system has been in service in the past but has been shut down permanently or for an extended indefinite period of time.
FGD Vendor	A firm which fabricates and supplies FGD systems, most notably the flue gas treating and ancillary equipment.
Fuel Characteristics	Type of fuel, average gross heating value in Btu/lb. average percent ash and average percent sulfur content for fuel as fired.
New	FGD unit and boiler were designed at the same time or space for addition of an FGD unit was reserved when boiler was constructed.
Nonregenerable	The SO_2 removed from the flue gas is not recovered in a usable or marketable form and resulting sulfur-bearing waste products must be disposed in an environmentally acceptable fashion.

Operational Experience	Summary of FGD status and description of current month's progress.
Process	Company name if process is patented. Generic name if several companies have similar processes.
Regulatory Class	A. New boiler constructed subject to Federal New Source Performance Standards. B. Existing boiler subject to State Standard that is more stringent than the Federal New Source Performance Standard (NSPS). C. Existing boiler subject to State Standard that is equal to or less stringent than NSPS. D. Other (unknown, undetermined).
Regenerable	The SO_2 removed from the flue gas is recovered in a usable or marketable form (e.g., sulfur, sulfuric acid, gypsum, ammonium sulfate, sodium sulfate).
Retrofit	FGD unit must be added to an existing boiler not specifically designed to accommodate FGD unit.
Sludge Disposal	Disposal method for nonregenerable systems producing sludge including: lined or unlined ponds, stabilized or unstabilized sludge, and on- or off-site disposal, disposal type (minefill, landfill, structural fill). For the regenerable systems, the form or method of sulfur recovery is provided (e.g. - molten elemental sulfur, sulfuric acid plant).

Start-up Date	Date when initial SO_2 removal began or is scheduled to begin.
Total FGD System Lost Generation Factor	The total monthly lost generation hours due to FGD train outages divided by the total monthly expected generation if the FGD trains would have been available for operation, expressed as a percentage.
Unit Cost	Capital Cost in $/kW including: SO_2 absorption and regeneration system, SO_2 recovery system, solids disposal, site improvements, land, roads, tracks, substation, engineering costs, contractors fee and interest on capital during construction. Annualized Cost in mills/kWh including fixed and variable costs. Fixed costs include: interest on capital, depreciation, insurance, taxes, and labor costs including overhead. Variable costs include: raw materials, utilities, and maintenance.
Unit Location	City and State listed in mailing address.
Unit Name	Unit identification as it appears in Electrical World - Directory of Electrical Utilities, McGraw-Hill - Current Edition - or as indicated by utility representative for installations in planning stages.
Unit Rating	Operational - Maximum continuous gross generation capacity in MW; Preoperational - maximum continuous design generation capacity in MW.

Utility Name	Name of corporation as it appears in Electrical World - Directory of Electrical Utilities, McGraw-Hill - Current Edition - as space permits.
Water Make-Up	Gallons per minute of make-up water required per MW of capacity.